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ERRATA

Page 40	line 12	for	'811'	read '311'
76	15	,,	'Vong (W. G.)	,, 'Wang (G. V.)'
91	lines 46 and 47	for	'does not attack'	read 'attacks'
109	last line	for	'24'	read '34'
114	last line	for	'*T. agrarium*'	,, '(?) *Medicago lupulina*'
161	line 42	for	'*L. beckii*, *Chionaspis*'	,, '*L. beckii* and *Chionaspis*'
164	23	,,	'A'	,, '*Agropyron*'
169	39	,,	'*distochya*'	,, '*distachya*'
205	22	,,	'*tabaci*'	,, '*tabacum*'
208	18	,,	'668'	,, '688'
215	8	,,	'*trabae*'	,, '*trabea*'
238	22	,,	'Wellhausen (F. J.)'	,, 'Wellhausen (E. J.)'
278	38	,,	'*Althyrium*'	,, '*Athyrium*'
284	3	,,	'Coop'	,, 'Copp'
285	1	,,	'Fourmont (P.)'	,, 'Fourmont (R.)'
287	13	insert 'reaction to' before 'bean'		
311	33	for	'*hesperedica*'	read '*hesperidica*'
325	44	,,	'*sclerotiorum*'	,, '*trifoliorum*'
369	6	,,	'*phaseoli*'	,, '*medicaginis* var. *phaseolicola*'
416	8	,,	'xlvii'	,, 'xcvii'
442	13	,,	'*ircanum*'	,, '*incanum*'
452	29	,,	'xvi'	,, 'xxvi'
471	19	,,	'cystalline'	,, 'crystalline'
492	lines 47 and 48	for	'*platanicola*'	,, '*platanifolia*'
507	line 6	for	'*humulis*'	,, '*humilis*'
536	38	,,	'Slink-Mezencevová'	,, 'Slinko-Mezencevová'
560	39	,,	'New Hampshire'	,, 'England'
565	1	,,	'*paucispora*'	,, '*paucispinosa*'
572	16	,,	'16'	,, '160'
588	17	,,	'*apii*'	,, '*apii-graveolentis*'
634	18	,,	'two first-named'	,, 'same'
676	16	,,	'*rosae*'	,, '*rosea*'
715	40	,,	'*cardinalis*'	,, '*cardinale*'
740	16	,,	'Elliot'	,, 'Elliott'
755	lines 25 and 26	for	'calcium chloride'	read 'chloride of lime'
797	line 47	for	'Milbraith'	read 'Milbrath'
798	33	,,	'*diagremontiana*'	,, '*daigremontiana*'
824	16	,,	'hosts'	,, 'host'

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
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LEACH (J. G.), ORR (L. W.), & CHRISTENSEN (C.). **Further studies on the interrelationship of insects and fungi in the deterioration of felled Norway Pine logs.**—*J. agric. Res.*, lv, 2, pp. 129–140, 6 figs., 2 graphs, 1937.

The results of experiments started in May, 1931, and terminated in September, 1934, which were conducted on lines similar to those described in a previous paper by the authors [*R.A.M.*, xiv, p. 137], showed that by the end of the third year after felling the entire sapwood and a considerable portion of the heartwood of Norway pine (*Pinus resinosa*) logs were decayed, when the logs were left fully exposed to environmental conditions. The primary cause of the decay of both sap- and heartwood was found to be *Peniophora gigantea* [ibid., xiv, p. 270], which is apparently readily disseminated by wind and may enter the logs through cracks in the bark or through holes made by several species of insects. No evidence, however, was obtained indicating that this fungus is dependent on insects to enable it to infect the logs, but the fact that a fair degree of correlation was established between the number of Cerambycid beetles (*Monochamus scutellatus* and *M. notatus*) in the logs and the amount of heartwood decayed suggests that the larvae of these insects hasten the decay by facilitating the radial and tangential invasion of the heartwood by *P. gigantea*. The other species of insects living inside the logs or inhabiting the bark and outer layers of the sapwood appear to have little influence on wood decay.

FINDLAY (W. P. K.) & PETTIFOR (C.B.). **The effect of sap-stain on the properties of timber. I. Effect of sap-stain on the strength of Scots Pine sapwood.**—*Forestry*, xi, 1, pp. 40–52, 1937.

This is a full account of the experiments to test the effect of *Ceratostomella coerulea* (*Ophiostoma coeruleum*) on the mechanical properties of the sapwood of Scots pine (*Pinus sylvestris*), a preliminary report of which has been noticed from another source [*R.A.M.*, xv, p. 185]. The results showed that the presence of *C. coerulea* and of another blue-staining, as yet unidentified fungus (S 51), isolated from heavily stained sapwood of slash pine (*P. caribaea*), had no appreciable effect on the compressive or the bending strength of the wood, but that it caused a marked reduction in toughness (measured as the energy absorbed in fracturing a test piece at a single blow) and a slight reduction in hardness. The effect on toughness was much greater in timber that had been first steamed at 100° C. for 90 minutes, in one case this

reduction being as high as 40 per cent. of the values for unstained controls, while the highest reduction in unsteamed stained timber was only 30 per cent. From a practical standpoint, it is stated that blue stain is deleterious only when timber of exceptional toughness is required, but blue-stained sapwood should never be used for purposes requiring a high resistance of the timber to suddenly applied loads.

JONES (A. W.). **Wood preservation.**—*Min. Mag., Lond.*, lvii, 1, pp. 19–28, 2 figs., 1 diag., 1937.

The characteristics of various wood preservatives are described with special reference to conditions in mines [*R.A.M.*, xvi, p. 788]. Neither brushing nor steeping is a wholly effective method of application, but the open-tank treatment gives very satisfactory results if properly applied with heating to 175° to 180° F. Pressure impregnation, however, is the most reliable method of applying creosote; outlines are given of the Burnettizing (full cell), Rueping, and Lowry (both partial cell) processes [ibid., xii, p. 670; xv, p. 545, *et passim*], the time occupied by the first-named being estimated at 7¼ hours, while the two others each take 4 hours 20 minutes. Changes in either vacuum or pressure must always be very gradually made, or the cell walls, particularly of the softer woods, may be broken down; internal temperatures should never exceed 240°. When zinc chloride is used the solutions should be frequently tested for hydrochloric acid (which decreases the strength of the wood) and for basic zinc chloride (reducing the strength of the preservative). Operating procedure is described in some detail, supplemented by the plan of a small pressure plant. The estimated costs per cu. ft. of 5 per cent. zinc chloride, 5 per cent. Wolman salts, and creosote (10 lb. per cu. ft.) are 2*s.* 7*d.*, 6*s.* 0*d.*, and 7*s.* 5*d.*, respectively.

FINDLAY (W. P. K.). **Decay of structural timber in cold stores.**—*Proc. Brit. Ass. Refrig.*, xxxii (*1936–37*), pp. 49–54, 1937.

In the course of a popular account (followed by a discussion, pp. 55–61) of the conditions favouring activity of wood-destroying fungi in cold stores, chiefly *Merulius lacrymans*, *Poria vaporaria*, and *Coniophora cerebella* [*C. puteana*: *R.A.M.*, xvi, p. 789], and the possibilities of their control, the writer advocates treatment of the timber with sodium fluoride (6 oz. per gall. water), a coating of aluminium paint, and the use of baked cork slabs for insulating purposes. Wood actually invaded by *M. lacrymans* or *P. vaporaria* should be excised for 12 to 18 in. beyond the last visible signs of attack, while exposed brickwork should be sterilized with a blowlamp flame or by antiseptic treatment, the remaining sound timber and any new wood used for replacements also being thoroughly disinfected. In the case of *C. puteana* only the diseased parts need be cut out.

CARTWRIGHT (K. St. G.). **The causes of stain and decay in imported timber.**—*Dep. sci. indus. Res. For. Prod. Res. Rec.* (*Mycol. Ser.* 2), 18, 15 pp., 7 pl., 2 figs., 1937.

In this paper the author distinguishes two main causes of the discoloration of imported timber at the port of entry: (1) chemical, (2) biological, e.g., sap-staining organisms, moulds, and wood-decaying fungi.

Chemical stains are more or less superficial, usually distributed in spots or irregular blotches bearing no relation to the grain of the wood, and may be rust-red, black, blue, or grey.

Staining is distinguished from decay by being mostly confined to the sapwood, causing blue, blue-grey, or green, or occasionally pink or yellow discoloration with no appreciable weakening of the timber. Dote, often loosely used as an alternative to decay, is defined as localized patches or pipes of incipient decay.

Fungi do not develop appreciably in timber of 20 per cent. moisture or less, and growth is slow when it is below 30 per cent. The higher the temperature up to about 80° F. the more rapid will be the development of the fungi, provided sufficient moisture is present; below 40° growth is usually slow, and none occurs below about 35°. Deep penetration of stain indicates that the sapwood has remained moist for a long time, and suggests that the timber was moist when shipped. Where stain or active mould growth is confined to the surface it definitely indicates the presence of surface moisture, due either to moisture movements from the interior of imperfectly seasoned timber, to water moistening the exterior, or a combination of both. If the mould growth is dry and the moisture content reasonably low, the timber was probably exposed before shipment to rewetting. Deep-seated stain, fairly uniform in distribution, almost invariably suggests that the unseasoned timber was close piled for at least two or three weeks. Spotting often results from rain or drip on seasoned timber. Extraneous internal decay indicates infection in the standing tree and rot that is confined to the sapwood points to infection after felling.

The paper concludes with recommendations for control by drying the timber to a moisture content of under 20 per cent. and protecting it from further wetting, or by dipping in an antiseptic immediately after conversion.

Boller (E. R.). **Preservative treatment of green southern Yellow-Pine timber with zinc chloride and zinc chloride-sodium bichromate.**—*Proc. Amer. Wood Pres. Ass.*, xxxiii, pp. 262–278, 3 graphs, 1937.

Green southern yellow pine [*Pinus palustris* and other species] timber was shown to be capable of satisfactory impregnation with zinc chloride-sodium bichromate (5 : 1) [*R.A.M.*, xvi, p. 79] or the former alone by conditioning with either steam or water at 260° F., subjecting to vacuum and pressure, and treating with a 5 per cent. solution of the preservative at 165°. The time required for the process may be curtailed by conditioning the wood with the solution at 260°, subjecting to vacuum and pressure, and then treating with a 5 per cent. solution of the preservative at 220° to 260°. A fairly satisfactory treatment with zinc chloride can also be made, omitting the application of vacuum following conditioning. The moisture content of the treated wood can be appreciably reduced by the application of a final vacuum. In general, treatment reduced the moisture content of the green pine when the initial humidity was high, but raised it when the initial content was relatively low. Some indication was given that the treatment would minimize deterioration of the pine when kiln-dried under unfavourable conditions.

Chidester (Mae S.). **Temperatures necessary to kill fungi in wood.**—*Proc. Amer. Wood Pres. Ass.*, xxxiii, pp. 316–324, 2 diags., 1 graph, 1937.

The results of experiments in the exposure of sapwood sticks of loblolly pine (*Pinus taeda*) inoculated with *Poria incrassata*, *Lenzites sepiaria*, and *Lentinus lepideus* in test-tubes to temperatures ranging from 149° to 212° F. for varying periods indicated that all three fungi succumb after an hour at 150°, half an hour at 170°, 20 minutes at 180°, 10 at 200°, or 5 at 212°, provided the moisture content of the wood remains above fibre saturation point. These data apply to material heated in steam or hot oil. Higher temperatures or longer periods of exposure are probably necessary to kill the organisms in wood heated in air with 35 to 40 per cent. relative humidity.

Kaufert (F.) & Schmitz (H.). **Studies in wood decay. VI. The effect of arsenic, zinc, and copper on the rate of decay of wood by certain wood-destroying fungi.**—*Phytopathology*, xxvii, 7, pp. 780–788, 1 graph, 1937.

The addition of low concentrations of arsenic trioxide [*R.A.M.*, xvi, p. 649] to Norway pine [*Pinus resinosa*] sawdust was shown definitely to stimulate its decay by *Lenzites trabea* and *Lentinus lepideus*, while even the lowest concentration used (50 p.p.m.) was toxic to *Trametes serialis* and *Polyporus anceps*. *L. lepideus* and *Lenzites trabea* were incited to more extensive rotting of the sawdust by the addition of zinc chloride at concentrations of 100 to 400 p.p.m., whereas above the latter strength this compound was apparently toxic to both fungi. *Lentinus lepideus* seems to be considerably more resistant to copper sulphate than *Lenzites trabea*, while the relationship is reversed in the case of arsenic trioxide; the experiments with the former compound, however, gave somewhat inconclusive results.

Schmitz (H.), Schrenk (H. v.), & Kammerer (L.). **The quality and toxicity of coal-tar creosote extracted from Red Oak ties after long periods of service, with special reference to the decay resistance of treated wood.**—*Proc. Amer. Wood Pres. Ass.*, xxxiii, pp. 35–90, 1 fig., 11 diags., 4 graphs, 1937.

From the results [which are fully discussed and tabulated] of an exhaustive inquiry into the quality of the extracted creosotes and a study of decay resistance, under conditions conducive to the growth of the wood-destroying fungi, *Fomes annosus* [see next abstract], *Lentinus lepideus*, and *Trametes serialis*, of the wood of two red oak [*Quercus rubra*] sleepers after comparatively lengthy service periods (No. 246 having been laid down in 1918 and No. 247 in 1923), the following conclusions are reached. Changes occur during the service period in the specific gravities, distilling ranges, and physical characteristics of the creosotes, especially in the outer layers of the treated wood. Wide variations in the toxicity of the extracts from different zones of the wood were also registered, but these appear to be of little practical significance, the treated material from all parts of both sleepers (of which 246 was impregnated with a heavy creosote and 247 with a light one) being decay-resistant even after ten months' exposure to

actively growing wood-destroying fungi. Observations on the movement of the creosote constituents in the wood denote that in all probability the creosote in the interior of the sleeper serves as a reservoir whence the outer layers are supplied; hence the larger the amount of creosote originally injected, the longer will this feeding process continue and the expectation of durability will be correspondingly increased. It is apparent from these data that the initial toxicity of creosote and other coal-tar products cannot be taken as a guide to the ultimate value of the preservative, and no method is known to the writers whereby the above-mentioned gradual changes in toxicity in different zones of the treated wood during the service period could have been predicted or evaluated at the time of impregnation.

Richards (C. Audrey). **The doubtful identity of fungus No. 517.**—*Proc. Amer. Wood Pres. Ass.*, xxxiii, pp. 104–106, 1937.

A comparison has recently been made of culture No. 517 of the Madison (Wisconsin) branch of the Division of Forest Pathology, which was isolated by C. J. Humphrey from a sporophore, ostensibly of *Fomes annosus* [*R.A.M.*, xvi, p. 290], from mine timber in 1910 and has since been consistently used in timber preservation tests, with *Polyporus tulipiferus* No. 691 [loc. cit.] and typical *F. annosus* cultures. Both 517 and *P. tulipiferus* differ from typical *F. annosus* cultures in the production of cystidia and in their larger basidiospores, as well as in their rapid growth at 35° C., at which temperature the development of *F. annosus* proper is entirely inhibited [ibid., xiii, p. 413]. In the absence of sporophores 517 cannot be definitely identified, and it is suggested that it should be temporarily referred to by its number in order to avoid possible confusion with the type species, now widely used throughout the world in the toximetric determination of wood preservatives.

Ogilvie (L.) & Hickman (C. J.). **Progress report on vegetable diseases. VIII.**—*Rep. agric. hort. Res. Sta. Bristol, 1936*, pp. 139–148 [1937].

Owing to the cool, moist conditions prevailing during the summer, anthracnose (*Colletotrichum lindemuthianum*) [*R.A.M.*, xiv, pp. 670, 734; xvi, p. 660] became very prevalent on dwarf beans [*Phaseolus vulgaris*] in 1936 at Long Ashton, though the Princess and Hundred for One varieties remained unaffected, and Lightning, Unrivalled, and Best of All were only slightly attacked. Mosaic [ibid., xvi, p. 439] was somewhat widespread, the symptoms being most conspicuous on the Emperor William and Keeney's Stringless Refugee varieties, of which the latter is now commonly grown for canning in England. Foot rot (*Fusarium solani* var. *martii*) [ibid., xiv, p. 730] of dwarf beans was again prevalent in Worcestershire. Runner beans at Offenham, Worcestershire, showed sporadic infection of the bases of subsidiary branches (which wilted and collapsed) by a species of *Sclerotinia*.

Early cauliflowers growing at Mickleton, Gloucestershire, were seriously affected in July, 1936, by a condition which had affected 75 per cent. of a crop of cauliflowers and Savoy cabbages at Ross-on-Wye in 1933. In addition to the deformed, strap-like leaves noted in the earlier occurrence, the affected plants at Mickleton showed leaves

present in the curd; the condition occurred in fairly well-defined areas, as it had previously. The symptoms resemble those of 'whiptail' [ibid., xiii, p. 344] attributed to lime deficiency; soil samples from Ross showed 0·098 per cent. exchangeable calcium oxide and a P_H value of 4·99, while two others from affected areas at Mickleton showed 0·762 and 0·859 exchangeable calcium oxide and free calcium carbonate in both.

In a summer trial of 89 lettuce varieties occasional cases of 'drop', due to *Sclerotinia sclerotiorum* [*R.A.M.*, xvi, p. 797] and possibly other species were noted. Mosaic [ibid., xv, p. 763] was present only to a very slight extent, probably because the severe winter had reduced the number of aphids. Some of the plants showed a condition suggestive of 'big vein' [ibid., xiv, p. 283], which had been noticed previously in the vicinity. All the summer varieties showed severe leaf infection by *Botrytis* [*cinerea*: ibid., xv, p. 196], and most of the seeds gathered were heavily infected in the cotyledons with mycelium which was still viable after two months; when the seeds were sown patches of the fungus were produced in the soil and served as infection centres for the healthy seedlings. One commercial sample of lettuce [seed] contained infected seeds.

Immersion of mint [*Mentha villoso-nervata*] runners in water at 105° to 115° F. for ten minutes during mid-February, when observations indicated that the mycelium of *Puccinia menthae* [ibid., xv, p. 763] was present in the shoots, completely controlled the disease.

During July large patches of peas in one locality in Wiltshire died off as a result of infection of the stem bases by *Pythium ultimum*.

DOWSON (W. J.) & DILLON WESTON (W. A. R.). **Soft rot of Broccoli.**— *Gdnrs' Chron.*, cii, 2636, p. 14, 1937.

During the spring of 1937 broccoli plants at the University Farm, Cambridge, and elsewhere, were severely attacked by *Bacterium carotovorum* [*Erwinia carotovora*], which induced a soft, dark, malodorous decay of the curds. The organism had probably been splashed from the soil on to the plants by the heavy rains in the early part of the year.

TOMPKINS (C. M.). **A transmissible mosaic disease of Cauliflower.**— *J. agric. Res.*, lv, 1, pp. 33–46, 5 figs., 1937.

This is a full account of the author's investigations on the virus disease of cauliflowers in California, a preliminary report of which has already been noticed from another source [*R.A.M.*, xiv, p. 207]. The first symptom of the disease, both in natural and artificial infection, is a clearing of the veins, usually beginning at or near the base of the leaf; this condition may persist for 10 to 20 days, but gradually changes to veinbanding, consisting of narrow, continuous, dark green areas parallel with and adjoining the midrib and lateral veins, which with dark green interveinal islands give the leaf a mottled aspect. Later small, irregular, light tan necrotic lesions occur in the mottled areas, often accompanied by curvature of the midrib and leaf distortion. Early infection usually results in severe stunting of the plants, but even in the absence of stunting diseased cauliflowers are not desirable for shipment because of the bleaching or yellowing of the mottled leaves in transit. Under greenhouse conditions, the symptoms developed well

at temperatures between 10° and 19° C., but became masked at higher temperatures. As determined by H. H. P. Severin, transmission of the disease in the field is effected by *Brevicoryne brassicae*, *Rhopalosiphum pseudobrassicae*, and *Myzus persicae*, and the virus was shown to be also transmissible by artificial juice inoculation with carborundum as abrasive. The virus withstands ageing *in vitro* for 14 to 15 days, is inactivated at approximately 75°, and tolerates about 1 in 2,000 dilution. Its host range includes 51 vegetable varieties, 3 ornamentals, and 5 weeds, all belonging to the Cruciferae.

GIDDINGS (N. J.). **A greenhouse method for testing resistance to curly top in Sugar Beets.**—*Phytopathology*, xxvii, 7, pp. 773–779, 2 figs., 3 graphs, 1937.

The following is the writer's method of testing selected strains of sugar beet for resistance to curly top in the greenhouse [*R.A.M.*, xvi, p. 650]. The plants are grown in boxes, $22\frac{1}{4}$ by $5\frac{1}{2}$ by $4\frac{3}{4}$ or $6\frac{3}{4}$ in., usually six pairs per box, and the inoculations are generally made on seedlings in the two true-leaf stage five to eight days after transplanting. One viruliferous beet leafhopper [*Eutettix tenellus*] is used per plant and allowed to remain for a week. Notes are taken at the end of the inoculation period, at three- or four-day intervals for about a fortnight, and then at weekly intervals for five or six weeks. An ascending scale of five grades is used for rating the degree of severity. In a series of comparisons between the U.S. 1 variety and a number of susceptible strains, 65 per cent. of the former and 78 per cent. of the latter became infected, the corresponding average severity of the attacks being 3·3 and 4·3 per cent. respectively. The average incubation period for U.S. 1 was 10·1 days, and for a susceptible strain, 2705–24, 8·6 days. Of the diseased U.S. 1 plants, 0 to 10 per cent. died during the tests, the corresponding figures for 2705–24 being 10 to 49 per cent. The results secured by this method appear to be comparable to those obtained in the field.

DAVIS (G. N.) & HENDERSON (W. J.). **The interrelation of the pathogenicity of a Phoma and a Fusarium on Onions.**—*Phytopathology*, xxvii, 7, pp. 763–772, 4 figs., 2 graphs, 1937.

Combined attacks of pink root (*Phoma terrestris*) and bulb rot (*Fusarium* [*vasinfectum* var.] *zonatum* f. 1) of onions [*R.A.M.*, xvi, p. 440] has caused the temporary abandonment of some 200 acres of valuable land under this crop in Iowa. *P. terrestris* is responsible for heavy seedling losses in infested fields, and may attack the roots at any time during the growing season, while *F.* [*vasinfectum* var.] *zonatum* f. 1 causes a semi-dry rot of bulbs both in the field and in storage, but does not invade the bulbs or roots except following injury or infection by another pathogen. Both fungi have the same optimum temperature (28° C.) and grow well over a P_H range of 3·8 to 7·6, with an apparent peak at 5·4 to 5·8, but *F.* [*vasinfectum* var.] *zonatum* f. 1 seems to be more sharply limited than *P. terrestris* on the alkaline side of the scale. Neither disease is amenable to control by soil or seed treatment, but by means of selection and inbreeding five strains of Red and Yellow Globe onions have been isolated which sustained less than 5 per cent.

loss from bulb rot in the field and in storage during 1935–6, when the damage to the checks amounted to 90 per cent. Little progress has yet been made, however, in the development of resistance to pink root.

PASSALACQUA (T.). **Una probabile virosi della 'Vicia faba L.' (Nota preliminare).** [A probable virosis of *Vicia faba L.* (Preliminary note).]—*Riv. Pat. veg.*, xxvii, 5–6, pp. 145–148, 1 fig., 1937.

Broad beans (*Vicia faba*) growing near Palermo were affected by a disease characterized by a conspicuous dwarfing of the plants, shortening of the internodes, and flattening of the stem, which remained unbranched at the base. The leaves dried up from the margins inwards, and turned tobacco-colour. Very few flowers were formed and the fruits remained small and wilted. No causal organism was isolated, and the author considers that the condition, which resembles in some respects court-noué of the vine or drought effects, was probably due to the action of a virus.

NELSON (R.), COONS (G. H.), & COCHRAN (L. C.). **The Fusarium yellows disease of Celery (Apium graveolens L. var. dulce DC.).**—*Tech. Bull. Mich. agric. Exp. Sta.* 155, 74 pp., 18 pl. (1 col.), 1937.

Two forms of *Fusarium* yellows of celery occur generally in the Michigan celery districts [*R.A.M.*, xiv, p. 418; xvi, p. 158]. Form I causes retardation of the growth rate and dwarfing, followed by a fading of the colour of the older leaves due to small flecks of chlorotic tissue that appear in the interveinal areas, sometimes localized at the edge of the leaflet. Under favourable temperature conditions a definite mottle appears. Later, the green disappears from the lamina, but the veins remain pale green, and subsequently the whole leaflet approaches a uniform straw-yellow and finally cream, wilting occasionally setting in before this stage is reached. The vascular tissues are brown or red from the ends of the invaded fibrous roots to the crown or even the leaflets. The crown tissue may be extensively decayed. The leaves frequently become brittle, especially in the green varieties, in which this symptom and dwarfing may be the only apparent evidence of infection. Root rot is commonly present. The leaves and petioles develop an intensely bitter flavour, and the roots and crowns when cut open emit a characteristic pungent odour. Adventitious buds are stimulated to develop, the supernumerary petioles being frequently twisted and intertwined, while the petioles are sometimes split vertically near the base; two or more crowns may be present. In fatal cases a gradual or sudden wilt is the final stage.

In form II the first symptom is a downward curling of the youngest heart leaves, curling not being so pronounced in the older leaflets until after chlorosis has set in. Decolorization always appears first in the veins, which turn straw-yellow and, later, cream. Narrow bands of tissue on either side of the blanched veins next become decolorized, the arrangement of the green and yellow pattern being the exact opposite of that in a leaf of the same stage of development affected with form I. The whole leaflet finally turns a cream colour. The heart leaves remain green until the last stage of the disease. The Californian form of yellows appears to differ from forms I and II, but it is not yet

proved definitely to be distinct. Each of the Michigan forms was shown to be due to a different pathogen, that causing form I being named *F. apii* Nelson & Sherb. n. sp. (syn. *F. apii* Nelson & Cochran *nomen nudum* [ibid., xiv, p. 419], *F. orthoceras* var. *apii* Wr & Reinking), and that causing form II *F. apii* var. *pallidum* Nelson & Sherb. n. var. (syn. *F. apii* var. *pallidum* Nelson & Cochran *nomen nudum* [loc. cit.] and *F. orthoceras* var. *apii* f. 1 Wr & Reinking), each with a Latin diagnosis.

The organisms showed only slight morphological differences, but different colour reactions and responses to toxic substances in the medium. *F. apii* occasionally produced conidia in discrete, creamy pionnotes, the conidial measurements ranging from an average of 10 by 3·4 μ (0-septate) to one of 46·7 by 4·8 μ (5-septate, very rare), though typically these organs were 3-septate and averaged 39 by 4·3 (mostly 34·5 to 40·7 by 3·9 to 4·5) μ. The terminal, intercalary or intraconidial, subglobose to piriform, smooth chlamydospores, occurring singly or in chains of two, measured 8·6 by 7·9 μ. *F. apii* var. *pallidum* n. var. showed 0- to 6-septate conidia produced singly or in false heads and averaging, respectively, 10 by 3·4 μ and 56·7 by 4·5 μ, though typically these organs were 3-septate and averaged 39·3 by 4·3 (mostly 34·5 to 40·7 by 3·9 to 4·7) μ. The chlamydospores measured 8·5 by 8·1 μ, and the rare sclerotia were blue. The optimum growth temperature for the two organisms was, respectively, 28° to 29° and 26° to 28° C. Celery grew best at a soil temperature of 20° and the disease was most active at 26° to 30° soil temperature.

Control methods recommended consist in the exclusion of the pathogens from non-infested soils by steaming, improved cultural practices, and the use of resistant varieties such as Golden Self-Blanching, Curly Leaf Easy-Blanching, and Michigan Golden.

Brown (W.). **A study of the deterioration of Seakale stocks, with notes on some diseases of that crop.**—*J. Pomol.*, xv, 2, pp. 69–85, 1 pl., 1 diag., 1937.

Sea-kale (*Crambe maritima*), a high-priced vegetable crop grown in the vicinity of London, suffers from a deterioration of forcing qualities, in which nearly all the terminal buds of the crown of the root cuttings used for forcing remain dormant, whilst numerous small side buds sprout and give rise to thin, 'grassy' sea-kale of no commercial value. Details are given of investigations at Slough, started in 1931, the results of which indicated that the deterioration is mainly due to the usual presence in the stocks of a number of plants which do not force well but are strong growers, particularly in the spring, so that their number gradually tends to increase owing to the propagation methods in practice; manurial treatment, on the other hand, is only a factor of secondary importance in this respect, but fungal or virus diseases may also be a contributory factor. The history of a number of clones of both types is recorded and none of the good clones has shown any significant deterioration after 4 or 5 seasons. Roguing on the basis of leaf characters when the root system is small is recommended.

During the work it was observed that club-root [*Plasmodiophora brassicae*] may occasionally be very troublesome to the crop, but is

successfully kept in check by heavy liming of the soil. *Rhizoctonia crocorum* [*Helicobasidium purpureum*: *R.A.M.*, xv, p. 776] was met with only occasionally, more particularly on the distal parts of the roots, and very rarely interferes with the forcing of the crowns. *R.* [*Corticium*] *solani* causes a black rot of the leaf stalks in the forcing pits, and a natural disbudding of the plants in the field, occasionally resulting in the death of the whole plant. A sporadic leaf mottling was also observed, suggestive of a virus disease, but so far no evidence is at hand to support this view.

KLEBAHN (H.). **Untersuchungen über die Krankheiten des Meerrettichs. II. Bericht.** [Investigations on Horse-Radish diseases. Report II.]—*Phytopath. Z.*, x, 2, pp. 121–167, 16 figs., 1937.

Further investigations on the root blackening disease of horse-radish lately attributed by Böning to *Verticillium dahliae* [*R.A.M.*, xvi, p. 361] failed to convince the writer, as previously indicated [ibid., xiv, p. 419], of the implication of this fungus in the trouble. The blackening organism forms larger sclerotia than the minute structures typical of *V. dahliae*, imparting an almost black coloration to agar cultures, and should probably be regarded as a new species, for which the name *V. armoraciae* is proposed [without a diagnosis].

Diseased root fragments were permeated by branched, septate hyphae, 1 to 3·5 μ in diameter, with occasional spherical, hyaline or faintly tinted, sparsely echinulate conidia, 5 to 6 μ in diameter, borne singly at the tips of conidiophores 2 μ in diameter. Considerable difficulty is presented by the classification of this organism, which is tentatively designated *Zygodesmus armoraciae*. It is associated with a disintegration of the tissues into cord-like, shrivelled fragments, sometimes laterally joined, but no connexion with blackening was apparent.

A condition known as 'core rot' [ibid., xvi, p. 362] or 'hollowing' is characterized by a yellowish-brown discoloration and eventual disintegration of the xylem parenchyma, from which bacteria were isolated. Preliminary inoculation experiments resulted in the development of symptoms approximating to those observed in nature. There is some reason to suppose that 'hollowing' and 'red brittleness' [loc. cit.] may be different manifestations of the same agent, though the two disorders may be of distinct origin.

A strain of *Cystopus candidus* from horse-radish [ibid., xiv, p. 1; xvi, p. 361] was shown to be capable of attacking *Capsella bursa-pastoris*, but definite evidence of transmissibility in the reverse direction is still lacking.

Discussing the possibilities of combating these diseases, the writer insists on the primary importance of absolutely clean planting material. Crop rotation is another valuable means of control, since the pathogens of blackening, core rot, and red brittleness originate in the soil and penetrate the unavoidable wounds at the base of the cuttings, but where this is not practicable, some protective substance should be applied to the cuts. The control of *C. candidus* necessitates repeated field inspections during the spring, the burning of infected plants, and the treatment of the remainder with Bordeaux mixture.

Pizer (N. H.). **Investigations into the environment and nutrition of the cultivated Mushroom, Psalliota campestris. I. Some properties of composts in relation to the growth of the mycelium.**—*J. agric. Sci.*, xxvii, 3, pp. 349–376, 1 pl., 1937.

The investigations recorded in this paper were carried out to ascertain the properties of composts which influence the growth of *Psalliota campestris* [*R.A.M.*, xvi, p. 585] in the early stage of active development and penetration of the compost. Ten composts, each unsuitable for mushroom growing, sticky to the hand, and with a tendency to bind were used, and treated in a systematic manner so as to remove certain types of constituents in turn. After each treatment the altered compost was placed in tubes, autoclaved, and inoculated with spawn, and the resultant growth observed.

Extraction of the composts with ether and 95 per cent. alcohol did not materially affect the growth of the mycelium, whereas extraction with 70 per cent. alcohol and cold water altered the composts so that the fungus grew readily in them, though this did not invariably occur. When growth followed digestion with 70 per cent. alcohol, treatment with cold water always improved it. The effect of the cold water is to disperse and hydrate the lyophilic colloids and to remove from 7 to 9 per cent. of the organic matter and from 3 to 5 per cent. of the cork constituents, resulting in a less sticky compost capable of absorbing more water.

Three ways in which the substances removed by water and 70 per cent. alcohol may exert their toxicity are (1) by their chemical constitution, (2) by increasing the osmotic pressure, (3) by altering the dispersion of the organic material. Extraction with the two solvents may be expected to remove most of the toxic materials, and certainly all substances capable of exerting high osmotic pressure, but even so growth sometimes fails to take place. On the other hand, the idea that high dispersion of the colloidal constituents of composts is detrimental to the growth of mycelium affords a complete explanation of the results obtained. In further experiments on the effect of modifying the degree of dispersion on mycelial growth, the flocculating effect of sodium, ammonium, potassium, magnesium, and calcium ions was studied and calcium was found to be very active in producing aggregation, and the only cation to do so. The improvement brought about by absorbed calcium was outstanding and consistent, the other ions invariably causing a falling-off in growth. The correct degree of dispersion is, therefore, that given by excess of calcium ions, but there appeared to be no advantage in removing colloidal material provided it was flocculated by calcium ions. The effect of water-soluble substances in composts on mycelial growth was tested by absorbing water extracts on filter paper and inoculating the product with spawn. The results showed that there are no toxic compounds in the water extracts which have, in fact, a marked nutritive value, but that the water-soluble substances are detrimental in association with the insoluble constituents of the composts. The explanation of these facts lies in the tolerance of the mushroom mycelium to highly dispersed material, but if the latter is present in sufficient quantity growth is hindered or stopped. Other experiments

with water extracts absorbed on filter paper also indicated the significance of dispersion.

In discussing the results of his study the author emphasizes the importance of the degree of dispersion of the various constituents of the compost. Flocculation with calcium ions must result in a compost which is non-greasy, friable, and granular, but the reason why such a physicochemical change should render the compost more suitable to the fungus is not known. The obvious remedy to the grower against composts in bad condition is to add a sufficient quantity of calcium to the manure before composting is begun. Experiments [details of which await publication] with ground gypsum have shown that by the addition of this fertilizer in quantity sufficient to ensure a content of 1·5 to 2 per cent. in the finished compost, greasiness is prevented and normal growth obtained.

BERNARD (G.). **L'apoplexie de la Vigne.** [Vine apoplexy.]—*Agric. prat., Paris*, N.S., ci, 31, pp. 1111–1112, 1937.

A popular account is given of the 'apoplexy' disease of the vine [*Stereum necator* or *Fomes igniarius*: *R.A.M.*, xv, p. 199; xvi, p. 436], which is stated to occur throughout Europe and in western Asia, especially Syria and Palestine, causing heavy losses annually in the south of France, Italy, and southern Greece. Excellent control is obtainable by spring or autumn applications of a mixture of 20 kg. arsenious acid, 14 kg. carbonate of soda, 18 kg. soap, and 100 l. water, diluted 20 times in water.

CASALE (L.). **La necessità del risparmio del rame nella lotta antiperonosporica.** [The necessity of economizing copper in the control of Vine mildew.]—*Nuovi Ann. Agric., Roma*, xvii, 2, pp. 207–220, 1937.

The author points out that an economy in the amount of copper used in spraying vines against mildew [*Plasmopara viticola*] can be effected by incorporating substances in the spray mixture which maintain the copper in a soluble or at least readily diffusible condition so that less copper is required than in Bordeaux mixture, but more is present in an available form. Such mixtures were prepared by combining copper sulphate, copper chloride, and Caffaro powder with citric acid, sodium pyrophosphate, oxalic acid, and iron sulphate and rendered neutral by the addition of sodium hydrate or sodium carbonate.

In experiments with ten of these mixtures the largest amount of soluble copper (3·5 mg. copper per l.) after four washings of the dried residues (each at laboratory temperature and 100° C.) was given by a mixture of 200 gm. copper sulphate, 50 gm. citric acid, 5 c.c. 30 per cent. solution of ferric chloride per 100 l. with sufficient sodium hydrate to induce a neutral reaction [*R.A.M.*, xvi, p. 512], compared with a trace only for 1 per cent. Bordeaux mixture. The addition of citric acid to the mixture renders it more lasting in its effects than the latter, though containing only one-fifth as much copper. When the sodium hydrate was replaced by sodium carbonate, rapidity and duration of the action were still further improved. Further tests on a more extensive scale are to be carried out.

Plantesygdomme i Danmark 1936. Oversigt, samlet ved Statens plantepatologiske Forsøg. [Plant diseases in Denmark in 1936. Survey of data collected by the State Phytopathological Experiment Station.]—*Tidsskr. Planteavl,* xlii, 2, pp. 189–249, 12 figs., 2 graphs, 1937. [English summary.]

The following are among the items of interest in this report, prepared on the usual lines [cf. *R.A.M.*, xvi, p. 86].

Ascochyta imperfecta [ibid., xvi, p. 259] was detected on home-grown seed of *Medicago lupulina.*

With cultures of *Pseudomonas mors-prunorum* from Danish myrobalan [*Prunus divaricata*] leaves Dr. Wormald obtained positive results on the branches and stems of Victoria plums in England [ibid., xvi, p. 692]. This is believed to be the first record of the pathogen in continental Europe. One out of nine Bismarck and 5 out of 21 Cox's Pomona apples and 2 out of 25 hazel nuts [*Corylus avellana*] reacted positively to inoculations made by tying infected material of *Sclerotinia fructigena* [ibid., xvi, p. 86] from *P. divaricata* to the uninjured stalks.

Podosphaera leucotricha was very prevalent on apples [ibid., xvi, pp. 468, 756], though seldom destructive, and spraying with lime-sulphur or 1 per mille salicylic acid gave good control.

A very fair degree of resistance to potato blight (*Phytophthora infestans*) was shown by the Alpha and Gustav Adolf varieties. Wart disease (*Synchytrium endobioticum*) was reported from four new administrative areas, bringing the total at the close of 1936 to 121 [ibid., xvi, p. 56].

Bacterium [*Pseudomonas*] *tolaasi* was responsible for destructive outbreaks of disease in mushroom [*Psalliota* spp.] beds [ibid., xiv, pp. 146, 346], especially under excessively warm and damp conditions. Control measures should include maintenance of a temperature of 13° C. and disinfection of the irrigation water with 0·5 per cent. chloride of lime. Both *Myriococcum praecox* [ibid., xvi, p. 653] and *Monilia* [*Oospora*] *fimicola* [ibid., xvi, p. 726] have been more or less prominent since 1931, the former extensively infesting compost with a consequent serious reduction in the mushroom yield.

New phytopathological records for Denmark include *Pseudomonas* [*Bact.*] *medicaginis* var. *phaseolicola* on beans [*Phaseolus vulgaris*: ibid., xvi, pp. 441, 728], Masterpiece being among the varieties affected; *Septoria polygonicola* forming round or angular, sharply defined, brown spots with a paler edge on the Ruby variety of *Polygonum orientale*; *S. leucanthemi* producing circular, dark-bordered lesions on *Chrysanthemum maximum* leaves [ibid., x, p. 553]; *Ceratophorum setosum* on lupin (*Lupinus polyphyllus*) foliage [ibid., xvi, p. 655]; an *Alternaria* with 8- to 9-septate conidia, averaging 125 to 150 μ (including beak) in length but sometimes attaining 200 μ, the agent of an extensive and injurious spotting of *Zinnia elegans* leaves; and a strain of *Gloeosporium fructigenum* [*Glomerella cingulata*] on rotten cherries [ibid., xiv, p. 40].

Thomas (K. M.). **Administration Report of the Government Mycologist, Madras, for the year 1936–37 (detailed report).**—17 pp., 1 graph, 1937.

Experimental evidence obtained at Coimbatore during the period under review showed that rice plots given nitrogen alone or in

combination with other manurial ingredients had a significantly higher incidence of foot rot (*Fusarium moniliforme*) [*Gibberella moniliformis*: *R.A.M.*, xv, p. 777] than the control plot given a basal dressing of farmyard manure and the plots which did not receive nitrogen. The available evidence indicated that increased incidence is due to the fact that a nitrogen-yielding medium favours the growth of the fungus.

Heavy infections of *Piricularia oryzae* [see below, p. 61] occurred on G.E.B. 24 rice in hilly districts, though this variety is highly resistant in the plains [cf. ibid., xv, p. 779]. Three strains of G.E.B. 24 × Korangu samba crosses have been developed at Coimbatore which are highly resistant to *P. oryzae* and yield 10 to 18 per cent. more than the original Korangu samba stock.

Koleroga disease (*Phytophthora arecae*) [ibid., xv, p. 77] of areca palm [*Areca catechu*] appeared after several years of comparative quiescence in South Kanara in a very virulent form, and growers who failed to spray sustained heavy losses, in some instances amounting to the complete loss of the crop. Studies on the life-cycle of *P. arecae* showed that the fungus is unable to grow and multiply in the soil, though the resting conidia shed in the soil germinate abundantly when optimum moisture is supplied; resting conidia were trapped by aeroscopes at a height of 32 ft. above the ground.

From a disease of areca palm observed locally for the first time and characterized by a die-back of the flowering bunches and a shedding of the female flowers between December and February a *Gloeosporium* was isolated and proved by inoculation experiments to be parasitic on tender areca and coco-nut inflorescences.

Macrophomina phaseoli [ibid., xv, p. 778] was isolated from coriander [*Coriandrum sativum*]. Pot inoculation experiments with the horsegram [*Dolichos biflorus*] strain [loc. cit.] showed that the fungus killed 35, 10, and 0 per cent. of the *D. biflorus* plants in the first, second, and third fortnights, respectively.

Inoculation experiments demonstrated that at least three specialized strains of the fungus causing *Sclerospora* disease of cereals exist, the sorghum strain, infecting only sorghum and maize, the *Pennisetum typhoides* strain infecting only *P. typhoides*, and the 'tenai' [*Setaria italica*] strain infecting only *S. italica*.

In further resistance trials the Co. 213 sugar-cane showed 70 per cent. mosaic, as against 63·5 per cent. in the previous season, while Co. 205 (Pusa), 335, 352, 353, 355, 422, 434, P.O.J. 2878, and Uba remained unaffected [ibid., xv, p. 777]. In individual plants of Co. 361 the symptoms disappeared after a time, and after the canes were cut the ratoon shoots showed no leaf mottle. The growth from setts of such plants did not develop symptoms, and pin-prick inoculations from such plants to a highly susceptible variety such as Co. 213 did not produce infection. The virus in the masked plants presumably becomes attenuated and loses infectivity.

A new disease of red gram [*Vigna unguiculata*] was characterized by leaf mottling, stunting of the plants with leaf dwarfing, and failure to flower. The red gram jassid (*Empoasca* sp.) fed for 24 to 48 hours on infected leaves in two instances transmitted the disease to red gram plants.

Inoculation tests proved that the virus causing yellowing of sorghum [ibid., xv, p. 778] is not sap-transmissible, and that the vector, *Pundalaya simplicia*, is solely responsible for the spread of the disease.

NATTRASS (R. M.). **Annual report of Plant Pathologist for the year 1936.** —*Rep. Dir. Agric. Cyprus, 1936*, pp. 50–56, 1937.

Apart from work already noticed from other sources [*R.A.M.*, xvi, pp. 311, 555] the following items are of interest in this report [cf. ibid., xvi, p. 20]. During 1936, wheat growing in Cyprus was widely affected in certain districts by *Bacterium tritici* [ibid., xiv, p. 742] in association with nematodes, prevalence having increased since the year before. *Helminthosporium sativum* was isolated from the base of young wheat plants [ibid., xvi, p. 735], this being a new record for Cyprus. *Vicia sativa* was severely attacked by chocolate spot [ibid., xvi, p. 723], brown lesions developing on the stems, leaves, and pods, and yielding a *Botrytis* closely resembling *B. fabae*, the spores of which when sprayed on to *V. faba* leaves produced characteristic chocolate spot. *Uromyces ciceris-arietini* [ibid., ix, p. 204] was noted for the first time in Cyprus on *Cicer arietinum*. Tomatoes were again seriously attacked in various districts by *Oidiopsis taurica* [ibid., xvi, p. 588], the disease becoming serious in midsummer and curtailing the productive period of the plants. *Ascochyta* [*Didymella*] *lycopersici* [ibid., xvi, p. 781] was noted for the first time locally on tomato fruits. Other fungi attacking tomatoes included *Alternaria solani* and *Septoria lycopersici*.

Ascochyta pisi not only occurs on peas in Cyprus but also on *V. sativa* [cf. ibid., xiii, p. 612], *Lathyrus gorgonei*, and *L. ochrus*, on the last-named of which it causes serious infection; isolations from these hosts and *V. faba* and one from Baarn sufficiently resembled each other to be considered as one species.

Other records included *Alternaria crassa* on *Datura stramonium* [ibid., xiii, p. 597], *Sclerotinia sclerotiorum* [see above, p. 6] on *Antirrhinum* and, for the first time in Cyprus, on orange fruits [ibid., xv, p. 213], and *Entyloma fuscum* [ibid., xvi, pp. 63, 493], which commonly occurs on *Papaver rhoeas*, on the leaves and inflorescences of *P. somniferum*.

WALLACE (G. B.). **Annual report on plant pathology, 1936.**—*Rep. Dep. Agric. Tanganyika, 1936*, pp. 95–96, 1937.

In this report [cf. *R.A.M.*, xv, p. 703] it is stated that no reason has been found for modifying the view that sisal [*Agave rigida* var. *sisalana*] stump rot [ibid., xiv, p. 678] observed on three plantations in the Tanga district in 1936 is primarily due to soil nutrient deficiency. Maize leaf blight (*Helminthosporium turcicum*) was definitely recorded for the first time from the Iringa district. Evidence was obtained that the sulphur treatment of sorghum seed against grain smut [*Sphacelotheca sorghi*] and loose smut [*S. cruenta*] when carried out for several years in succession [ibid., xii, p. 552] reduces infection to insignificant proportions. Loose smut of wheat (*Ustilago tritici*) was recorded for the first time from Arusha. Loquat root rot was caused by *Armillaria* [*mellea*]. The avocado disease previously reported [ibid., xiv, p. 678] was ascertained to be due to capsid bugs (*Helopeltis*).

LEACH (R.). **Report of the Plant Pathologist, Mlanje Experimental Station.**—*Rep. Dep. Agric. Nyasald, 1936*, pp. 25–28, 1937.

This report [cf. *R.A.M.*, xv, p. 779] contains the following items of interest, apart from those already noticed from other sources [ibid., xvi, p. 564].

The planting of 1½-year-old tea stumps (stems cut back to 4 in.) sometimes failed, owing to ringing of the collar, apparently due to scorching, at ground-level, with resultant die-back and death of stump and root, unless suitable weather intervened. An experiment was therefore carried out in which the stumps were grown in shaded and unshaded conditions during all types of weather. The results obtained [which are tabulated] showed after one year significant differences of 3·3, 27, and 20 per cent. in stand in favour of the shaded over the unshaded stumps for (1) ideal planting weather followed by showery, cool weather (typical of a good planting season), (2) ideal planting weather followed by a hot, dry spell (typical of a bad planting season), and (3) planting on 30th December in the middle of a long, hot, dry spell, respectively. This result shows clearly that if shade can be used to prevent the collar of the stumps from being scorched by the hot surface soil a good standard of planting should be attained for all seasonal conditions.

Citrus exanthema [ibid., xvi, p. 741] was observed locally for the first time in January, 1936. Some trees were badly affected and had started to die back. Citrus mottle leaf [ibid., xvi, p. 669] is very prevalent in Nyasaland, but spraying with zinc sulphate and lime has given encouraging results.

LEFEBVRE (C. L.) & JOHNSTON (C. O.). **Kansas mycological notes, 1935.**—*Trans. Kans. Acad. Sci., 1936*, xxxix, pp. 95–101, 1937.

Among the many items of interest in these notes the following may be mentioned. *Bacterium coronafaciens* [*R.A.M.*, xvi, p. 370] was common on oats in Kansas in 1935, preventing the emergence of the head from the 'boot' in susceptible varieties, e.g., Canadian, Swedish Select, and Green Russian.

The incidence of kernel smut of sorghum (*Sphacelotheca sorghi*) [ibid., xvi, p. 667] was very high, amounting to 25 per cent. of the heads in some large commercial fields and frequently reaching 10 to 15 per cent. An atypical manifestation of the fungus, consisting in the production of large sori on the glumes, panicle branches, rachis, and occasionally on the peduncles below the heads, simulating the attacks of head smut (*Sorosporium reilianum*), was observed in the Manhattan experimental plots.

Bact. coronafaciens atropurpureum Reddy & Godkin was prevalent on *Bromus inermis*, *B. japonicus*, and *B. tectorum*, *Dactylis glomerata* being less severely attacked. The symptoms caused by this organism (a greenish-brown to black discoloration of culms, rachis, and pedicels of the panicle, sometimes entailing a high degree of sterility), are similar to those produced by *Bact. translucens undulosum* on wheat [ibid., xvi, p. 799], suggesting a close relationship between the two.

Late blight of potato (*Phytophthora infestans*) was found in several

fields, this being the first authentic record of its occurrence in the State; the affected plants were raised from seed of Maine origin.

Linospora gleditsiae, the agent of a leaf spot of honey locust (*Gleditsia triacanthos*), was found in both its conidial and perithecial stages [ibid., xv, p. 620].

Müller (A. S.). **Brazil: new plant diseases reported in the State of Minas Geraes during 1936.**—*Int. Bull. Pl. Prot.*, xi, 8, pp. 174–175, 1937.

This is a list of diseases first recorded in the State of Minas Geraes of Brazil in 1936, among which the following may be mentioned: *Exoascus* [*Taphrina*] *deformans* on peach, *Puccinia paulensis* [*R.A.M.*, xi, p. 606] and mosaic on *Capsicum microcarpum*, *Corticium salmonicolor* and psorosis on *Citrus* sp., *Ceratostomella fimbriata* on *Crotalaria juncea*, *Cercospora carotae* on carrots [ibid., xii, p. 356], and *Oidium tuckeri* [*Uncinula necator*] and *Sphaceloma ampelinum* [*Elsinoe ampelina*: ibid., xvi, p. 655] on the vine.

Pickel (B.). **Lista das molestias e dos fungos parasitarios das plantas cultivadas em Pernambuco.** [List of the diseases and parasitic fungi attacking cultivated plants in Pernambuco.]—*Rodriguésia*, ii, Num. esp., pp. 207–212, 1937.

This is a preliminary, briefly annotated list of the more important parasitic diseases of economic and ornamental crops, which have been studied by the author in Pernambuco, and among which the following may be mentioned: *Cercospora ricini* Speg. on castor bean [*Ricinus communis*] leaves; *Uromyces manihotis* Henn. killing the apical bud of cassava; *Puccinia psidii* [cf. *R.A.M.*, xvi, p. 300] common on the leaves and fruits of guava; and *Asperisporium caricae* [ibid., xv, p. 46] causing a leaf spot of papaws.

Matsumoto (T.) & Okabe (N.). **Bacteriophage in relation to Bacterium solanacearum. II. Further studies on the phage and antiphagic serum.**—*J. Soc. trop. Agric. Taiwan*, ix, 2, pp. 205–213, 1937.

A detailed account is given of the writers' studies on the longevity of the bacteriophage of *Bacterium solanacearum* [*R.A.M.*, xiv, p. 686] as influenced by (*a*) varying temperature conditions, and (*b*) the presence of homologous bacteria during the period of preservation. A 24-hour culture of the phage was distributed in small glass tubes which were sealed and maintained at different temperatures for given periods, after which a modicum of the solution was withdrawn from each tube and its lytic activity tested.

The longevity of the *Bact. solanacearum* phage was found to increase parallel with the decline in temperature at which the culture is preserved. The lytic principle lost its virulence, for instance, after 25 to 70 days at 37° C., whereas at 0° its activity was maintained for 700 days. The longevity of the phage varied according to the quality of the potatoes serving for the preparation of the media, being greatly reduced by the use of decoctions yielding a white precipitate on preservation at 0° to 10°. Marked differences were observed in the virulence of the bacteriophage towards three distinct types of *Bact. solanacearum*, viz., 'F' (a fluid form with irregular, milky colonies), 'Op'

(with circular, opalescent colonies), and 'C' (with circular, light brownish, concentric, striate colonies), the first-named being the most susceptible to the lytic action. The neutralization of the phage by antiphagic serum was found to vary with differences in the phagic titre. In one case complete neutralization took place at a dilution of 1:10 after two hours at 37°, while in another the same effect was produced at dilutions up to 1:80 under the same conditions. The neutralizing activity of the antiphagic serum was not affected by one hour's heating to 50° and little impaired by exposure to a temperature of 60° to 70°, but 20 minutes' heating to 75° induced considerable attenuation. At or above 85° even five minutes' exposure caused a marked reduction of activity, while 20 minutes at 85° or 10 at 90° resulted in almost complete destruction of the neutralizing properties of the serum.

LEVINE (M.). **Tumors of Tobacco hybrids.**—*Amer. J. Bot.*, xxiv, 5, pp. 250–256, 17 figs., 1937.

The author describes spontaneous tumours on *Nicotiana glauca* × *langsdorffii* hybrids [*R.A.M.*, xv, p. 205] which closely resemble crown gall (*Bacterium tumefaciens*) but are distinct from it, and may be compared with teratomata.

LINK (G. K. K.) & WILCOX (H[AZEL] W.). **Tumor production by hormones from Phytomonas tumefaciens.**—*Science*, N.S., lxxxvi, 2223, pp. 126–127, 1937.

The writers give further details of their experiments on tumour production in red kidney beans (*Phaseolus vulgaris*) by hormone extracts (heteroauxones) from *Phytomonas* [*Bacterium*] *tumefaciens*, an account of which [including similar tests on tomatoes] has been noticed from another source [*R.A.M.*, xvi, p. 730].

CONNER (H. A.), RIKER (A. J.), & PETERSON (W. H.). **The carbon metabolism of the crown-gall and hairy-root organisms.**—*J. Bact.*, xxxiv, 2, pp. 221–236, 2 diags., 5 graphs, 1937.

Quantitative data are presented concerning glucose fermentation, fermentation rates, carbon dioxide production, and carbon distribution of the metabolic products of the crown gall and hairy root organisms (*Phytomonas* [*Bacterium*] *tumefaciens* and *P.* [*Bact.*] *rhizogenes*) [*R.A.M.*, xvi, p. 591].

The amount of glucose fermented in a synthetic liquid medium by the two organisms may be increased by raising the concentration of yeast infusion or the addition of 1 per cent. phosphates. Agar media were more satisfactory for fermentation than liquid substrata. *Bact. rhizogenes* was capable of fermenting higher concentrations of glucose more rapidly than *Bact. tumefaciens* and also produced about ten times as much carbon dioxide. Acetic and pyruvic acids were identified as metabolic products of *Bact. rhizogenes*. From 70 to 80 per cent. of the sugar fermented is utilized for the formation of other products, some of which have been isolated and partly characterized. These metabolites differ from bacterial gum in their failure to yield reducing sugars on hydrolysis. The bacterial gum consisted chiefly (72 to 98 per cent.) of

SMITH (C. O.). **Crown gall on Incense Cedar, Libocedrus decurrens.**—*Phytopathology*, xxvii, 8, pp. 844–849, 3 figs., 1937.

This is an expanded account of the writer's successful inoculation experiments with cultures of *Pseudomonas* [*Bacterium*] *tumefaciens*, originally isolated from incense cedars (*Libocedrus decurrens*) in California in 1916, on a number of other trees and plants, a note on which has already appeared [*R.A.M.*, xv, p. 138]. Additional hosts of the organism reported in the present study are *Schinus molle* and persimmon (*Diospyros kaki*). Details are given of some atypical manifestations of crown gall on *L. decurrens* resulting from inoculation with cultures from the same host, peach, and willow (*Salix* sp.), including globose structures composed of healed-over tissue, 5 to 15 mm. in diameter, sometimes cracking and producing from their interior rudimentary galls that ultimately assume the typical form, and point-like or papillate projections arising near the site of inoculation or sometimes from the enlarged tissue.

BONDAR (G.). **A phytopathologia e a cultura Cacaoeira no Brasil.** [Phytopathology and the cultivation of Cacao in Brazil.]—*Rodriguésia*, ii, Num. esp., pp. 196–197, 1937.

The author states that while *Phytophthora faberi* [*P. palmivora*: *R.A.M.*, xvi, pp. 202, 312] is economically the most important fungal parasite of cacao in Brazil, very little attention so far has been paid to the disease in that country, and advocates a thorough investigation of the problems involved in its development and control.

GARRETT (S. D.). **The soil-borne fungus diseases of field and plantation crops: a review of existing control methods.**—*Emp. J. exp. Agric.*, v, 19, pp. 189–196, 1937.

In this survey of the methods of control of fungal root diseases in field and plantation crops the author points out that the problem is common to both temperate and tropical countries, and that most of the more serious fungal root parasites increase only on and in their host. He classifies the available control methods as those aimed at (1) getting rid of the fungus during its passive phase in the soil in the absence of host plants, (2) checking the subterranean activity of the fungus during its active, parasitic phase on the underground parts of the host, and (3) preventing the dispersal of the fungus to fresh areas by such agencies as wind, water, insects, animals, and agricultural practices. Regarding the methods included in the first category the author urges that more attention should be paid to biological control to increase the antagonistic action of soil saprophytes on root parasites, and so enable the period of fallow or alternate cropping necessary for the eradication of infection to be reduced. The second category includes measures designed to increase the resistance of the underground organs (e.g., by the correction of adverse soil factors), roguing, and measures directed at making the soil environment less favourable to the parasitic activity of the fungus. Methods of the third category are not discussed in detail.

BLAIR (I. D.). **Survey of certain crop diseases in Canterbury and North Otago.**—*N.Z. J. Agric.*, lv, 2, pp. 104–111, 1937.

This is a summarized report on the diseases of cereal crops which

were observed during a survey from December, 1935, to March, 1936, in South Island in the area comprised between Amuri in the north and Waitaki in the south. About 35 per cent. of the oat-growers visited did not disinfect their seed-grain before sowing, a fact which is held to have been responsible for the fairly even distribution of loose and covered smuts (*Ustilago avenae* and *U. kolleri*) in all the districts surveyed; of the two smut species the first, however, was much more common than the second. While Hunters wheat was apparently completely immune from loose smut of wheat (*U. tritici*), 95 per cent. of the Cross 7 crops were infected in some degree with the smut, the susceptibility of Dreadnought, Garnet, Tuscan, Velvet, Marquis, and Jumbuck wheats being in the descending order as listed. Support was found for the American experience that warm and damp weather during blossoming time favours the spread of loose smut of wheat. Wheat bunt [*Tilletia caries* and *T. foetens*] appeared to have been reduced to very little economic significance by the generalized practice of seed disinfection, for which ceresan and agrosan are becoming very popular. The highest percentage infection (60·8) with mildew (*Erysiphe graminis tritici*) was found in Hunters wheat and the lowest (29) in Jumbuck, Tuscan, Velvet and Pearl, Cross 7, and Dreadnought, showing 57·8, 57·0, 39·3, and 30·6 per cent., respectively. In certain districts, where the large number of whiteheads in wheat caused concern among the growers, there were indications that, apart from *Ophiobolus graminis* and other agencies, the condition was due to attacks of foot-rotting fungi (*Fusarium* spp.) [*R.A.M.*, xvi, p. 734].

Pichler (F.). **Saatgutbeizmittel.** [Seed-grain disinfectants.]—*Neuheiten PflSch.*, xxx, 4, p. 151, 1937.

Details are given of certain amendments and amplifications in the list of seed-grain disinfectants officially recognized by the Austrian Plant Protection Service [*R.A.M.*, xvi, p. 88]. Improved fusariol 157 (Chem. Fabrik Marktredwitz) [ibid., xv, p. 83] controls wheat bunt [*Tilletia caries* and *T. foetens*], covered smut of barley [*Ustilago hordei*], and barley stripe [*Helminthosporium gramineum*]. Wheat bunt may also be combated by means of germisan, by salvocer-nassbeize (Kreidl, Heller & Co., Vienna), and by salvocer-einheitsbeize (same manufacturers). Germisan is also effective against *U. hordei* on barley and *Fusarium* [*Calonectria graminicola*] on rye. *U. hordei* yields to salvocer-einheitsbeize and to abavit-neu dust, the latter preparation being applicable to *H. gramineum* on barley and loose smut of oats [*U. avenae*]. The manufacture of cersolit liquid and dust having been discontinued, these preparations are withdrawn from the official list.

Fischbach (H.). **Bayern und die Getreidebeizung.** [Bavaria and cereal disinfection.]—*Nachr. SchädlBekämpf., Leverkusen*, xii, 3, pp. 160–169, 4 figs., 1937. [English, French, and Spanish summaries on pp. 196–197, 200–201, 205.]

The author briefly reviews the development of co-operative seed disinfection in Bavaria [*R.A.M.*, xvi, p. 519] and states that in 1935 71, 88, and 69 per cent., respectively, of the winter rye, wheat, and barley were treated, the corresponding summer figures being 54, 75,

and 57, respectively, and oats 40 per cent. Continuous dusting machinery is now in operation at most of the depots.

LEHMANN (E.), KUMMER (H.), & DANNENMANN (H.). **Der Schwarzrost, seine Geschichte, seine Biologie und seine Bekämpfung in Verbindung mit der Berberitzenfrage.** [Black rust, its history, its biology, and its control in relation to the Barberry problem.]—xxiv + 584 pp., 1 col. pl., 41 figs., 21 graphs, 6 diags., 19 maps, Munich–Berlin, J. F. Lehmanns Verlag, 1937. Price RM. 28 (abroad RM. 21).

This well-presented and richly documented work on black rust of cereals (*Puccinia graminis*), probably the world's most important plant pathogen, is without doubt the largest and most complete monograph yet published on a single plant disease. The book is divided into eight main sections under the headings: introductory; the black rust fungus and its history; the barberry; the history of the struggle against the barberry; the biology of black rust parasitism, (*a*) on cereals, and (*b*) on the barberry; epidemiology of the black rust; the distribution and injuriousness of the rust throughout the world; and control of the rust, with particular reference to the eradication of the alternate hosts, i.e., the barberry and *Mahonia* spp. In a final chapter the authors discuss the measures that should be introduced in Germany [*R.A.M.*, xiv, p. 568] for the suppression of the disease, the control of which can only be obtained by close international co-operation. The information is presented in great detail and the volume constitutes a valuable book of reference for data on this important disease. The bibliography appended covers 57 pages.

MITRA (M.). **Studies on the stinking smut or bunt of Wheat in India.**—*Indian J. agric. Sci.*, vii, 3, pp. 459–476, 2 graphs, 1937.

The results of investigations from 1934 to 1936, inclusive, at Karna showed that wheat ears infected with bunt (*Tilletia indica*) [*R.A.M.*, xvi, p. 231] are significantly shorter and produce significantly fewer spikelets than normal. On an average for the three years' tests, naturally infected Pusa 114 wheat seed gave 1·48 per cent. bunted plants; seed disinfection with ceresan reduced the percentage infection to 0·14, and with copper carbonate, uspulun, granosan, charcoal formaldehyde, and hot water to 0·25, 0·28, 0·30, 0·42, and 0·54, respectively. Experiments in 1935–6 showed that bunt infection can occur, to a certain extent, when healthy seed is sown in infected soil, and that certain seed disinfectants, such as agrosan G, hortisan A (both at a rate of 2 oz. per bush.), and sulphur (7 oz.), reduce infection from this source. Further experiments showed that bunt does not develop at Pusa even if wheat is sown there in infected soil imported from Karnal. In view of the possibility of infection from the soil, crop rotation is strongly recommended.

PETIT (A.). **Le traitement des semences de Blé tendre contre Ustilago tritici. Trempages de courte durée dans l'eau chaude.** [The treatment of soft Wheat seed-grain against *Ustilago tritici*. Hot water steeps of short duration.]—*C. R. Acad. Agric. Fr.*, xxiii, 21, pp. 672–678, 1937.

In this later account of his experiments in Tunis in 1936 [*R.A.M.*,

xvi, p. 802] on the control of loose smut of wheat (*Ustilago tritici*) by double bath hot-water treatment, the author states that the disease may be reduced to one-tenth of its incidence in the controls by preliminary immersion for 40 minutes at 40° to 48° C.; to one-twentieth by 50 minutes at 38° to 43° or 48°; and to nil by $1\frac{3}{4}$ to $2\frac{1}{2}$ hours at 35° to 40°; these treatments being followed, in all cases, by a second immersion for 10 minutes at 52°. Total disinfection, however, inhibits germination at low temperatures and necessitates the sowing of 50 per cent. more seed, and is therefore not to be considered as a routine method for obtaining good, regular crops, but only when complete eradication of the disease, in three succeeding crops, is required.

The treated grain should be sown early, and not too deeply, in light, well-prepared soil at a density of one-third as much again as the customary rate, when a yield of two-thirds to four-fifths of that of untreated controls may be anticipated. This economically satisfactory method has been successfully employed on an extensive scale in Tunis for the procurement of large quantities of grain, and the healthy condition of the seed may be expected to persist for at least two generations.

While a single immersion of $1\frac{1}{2}$ to 2 hours at 46° to 48° is completely effective, this method has inherent disadvantages [loc. cit.].

CALDWELL (R. M.). **Rhynchosporium scald of Barley, Rye, and other grasses.**—*J. agric. Res.*, lv, 3, pp. 175–198, 4 pl., 3 figs., 1 graph, 1937.

In giving a full report of his investigations, started in 1926 in Wisconsin, of the *Rhynchosporium* scald of barley, rye, and other grasses [*R.A.M.*, viii, p. 371; xiv, p. 429], the author states that in the Pacific Coast States the trouble is one of the principal limiting factors in barley production, the losses directly attributable to it having been estimated at from 20 to 30 per cent. A critical study of the taxonomy and nomenclature of the genus *Rhynchosporium* led him to present an emended description of the genus, based on the distinctive fertile stroma and the production of sessile conidia directly on it as seen in the type species, *R. secalis* (Oud.) Davis occurring on barley, rye, and a number of grasses. The fungus causing scald of *Dactylis glomerata* differs from this species in having cylindrical instead of apically beaked conidia, and is described as a new species under the name *R. orthosporum* [with a Latin diagnosis]. *R. alismatis* (Oud.) Davis, occurring on *Sagittaria* and *Alisma* spp., is excluded from the genus.

R. secalis was found to exhibit a high degree of host specialization; cross-inoculations showed the existence of six specialized races, characterized by their behaviour on rye, barley, *Agropyron repens*, *Bromus inermis*, *Elymus canadensis*, and *Hordeum jubatum* in the greenhouse and in the field. The conidia of the different races produced on the hosts did not show any important morphological differences, but distinct and constant differences both in the shape of the conidia and in cultural characters were observed between the races in pure culture. The conidia germinated readily in distilled water at temperatures from 4° to 28° C., the optimum temperature for elongation of the germ-tube being between 18° and 21°. Fructification of the fungus occurs abundantly at high humidities and is inhibited by low relative humidities.

Infection on barley is effected by direct penetration of leaf cuticle from appressoria, the mycelium establishing itself and making its initial development under the cuticle, whence it penetrates the underlying epidermal cells and then sparsely into the mesophyll, causing the collapse of these tissues. The cuticle is pushed away from the epidermal wall by the developing subcuticular mycelium, which then forms a fertile stroma, one to several cells in thickness, over the surface of the lesion. In Wisconsin the barley strain of *R. secalis* has been shown to overwinter on the dead tissues of plants from the preceding crop.

Ikata (S.), Kasai (I.), Yosida (M.), & Yokota (I.). **Vitality of spores of stripe-disease fungus on Barley which have passed through the alimentary canal of cattle.**—*Agric. & Hort.* [*Japan*], xi, pp. 2164–2174, 1936. [Japanese. Abs. in *Jap. J. Bot.*, ix, 1, p. (6), 1937.]

Conidia of *Cephalosporium gramineum* Nisikado & Ikata, the agent of a stripe disease of barley in Japan [*R.A.M.*, xiii, p. 623], were found to pass quite unchanged, as regards morphology, viability, and pathogenicity, through the alimentary canal of cattle and poultry fed on infected culms and grains. One of the reasons for the striking retention of vitality by these organs is their adaptability to a wide range of hydrogen-ion concentrations, enabling them to withstand the acidity of the alimentary canal.

Brown (Mabel R.). **A study of crown rust, Puccinia coronata Corda, in Great Britain. I. Physiologic specialization in the uredospore stage.** —*Ann. appl. Biol.*, xxiv, 3, pp. 504–527, 1937.

Details are given of greenhouse experiments, conducted from 1932 to 1934 in England and during the following year in Canada, the results of which allowed the author to differentiate seven pathologically distinct varieties of *Puccinia coronata* [*P. lolii*: *R.A.M.*, xii, p. 364; xv, p. 9; xvi, pp. 245, 446, and next abstract] in Great Britain, namely, var. *alopecuri* parasitic on *Alopecurus pratensis*, var. *arrhenatheri* on *Arrhenatherum avenaceum*, var. *avenae* on *Avena* spp., var. *calamagrostidis* on *Calamagrostis lanceolata* and *Phalaris arundinacea*, var. *festucae* on *Festuca elatior*, var. *lolii* on *Lolium perenne*, and var. *holci* on *Holcus lanatus*, the two last-named of which have also been distinguished in North America. It was further shown that, while the varieties *holci* and *arrhenatheri* are strictly specialized to their own hosts, the other five varieties can all infect to some extent *Dactylis glomerata*, *P. arundinacea*, and *C. lanceolata*, and that the variety *lolii* can infect seven of the twelve differential hosts tested. Inoculation experiments carried out under different conditions of temperature and illumination indicated that the type of infection produced was but slightly influenced by variations in these factors. Marked variations were observed in the reaction of the different species of grasses when inoculated with one and the same culture of rust under identical conditions, this being probably due to genetic impurity of the grasses tested. Four physiologic races were recognized in the variety *avenae* from uredospores collected on oats, namely races 6 (previously identified in North America and Australia), 42 and 44 (both new) from England, and race 43 (also new) from Portugal. Race 42 is somewhat similar to race 9 but differs

in heavily infecting Glabrota, Belar, and Green Russian; race 43 resembles race 1 but differs in giving type 1 infection on Belar; and race 44 closely resembles 38 but causes heavy infection on White Tartar. It is also believed possible that other varieties of *P. coronata* may eventually be similarly subdivided into physiologic races, if pure lines of the host plants become available. From a practical standpoint the investigation indicated that grasses infected with *P. coronata* are seldom likely to be a cause of danger to cultivated oats.

No clear-cut evidence, either morphological or pathological, was obtained supporting Klebahn's division of Corda's species into *P. coronata* Kleb. and *P. coronifera* Kleb. (*P. lolii* Niels.), since most varieties were capable of infecting both *coronata* and *coronifera* hosts.

MURPHY (H. C.), STANTON (T. R.), & STEVENS (H.). **Breeding winter Oats resistant to crown rust, smut, and cold.**—*J. Amer. Soc. Agron.*, xxix, 8, pp. 622–637, 1937.

The results of greenhouse, laboratory, and field reaction trials in Iowa, Idaho, and Virginia on selections from Lee × Victoria and Hairy Culberson × Victoria oat crosses, using as foundation stocks 47 F_2 plants out of about 600 showing a tendency towards a winter habit in the seedling stage, are tabulated and discussed in relation to cold, physiologic race 1 of crown rust (*Puccinia coronata*) [*P. lolii*: see preceding abstract], and loose smut (*Ustilago avenae*) (similar to, or identical with, Reed's Missouri strain) in the F_3, F_4, F_5, and F_6 generations.

The distribution of F_3 plants on the basis of their reaction to *P. coronata* in the greenhouse suggests a genetic ratio of 1 : 2 : 1 in the F_2 for resistance, heterozygosity, and susceptibility. Most F_4 families of both crosses showed a satisfactory degree of resistance to crown rust. In most cases the character of resistance to crown rust in the seedling stage is analogous to that manifested in adult plants. Smut occurred in only two F_4 families of the Lee × Victoria cross and in none of the Hairy Culberson × Victoria combination. Of the 123 selections of both crosses tested in the F_5, 77 were resistant to smut in Idaho and Virginia. Under field conditions in Idaho in 1936 smut developed in 6 of 33 F_6 progenies.

BARGER (G.). **The alkaloids of ergot.**—*Analyst*, lxii, 734, pp. 340–354, 1 pl., 4 figs., 1937.

This is a critical review of outstanding investigations on the rye ergot (*Claviceps purpurea*) alkaloids [*R.A.M.*, xvi, p. 448], accompanied by full details of their constitution, directions for chemical and physical methods of assay, and observations on the toxicology of the substances.

PASINETTI (L.). **La 'bacteriosi del Mais' in Italia da 'Aplanobacter stewarti' Smith. Nota II.** [The Maize bacteriosis in Italy caused by *Aplanobacter stewarti* Smith. Note II.]—*Riv. Pat. veg.*, xxvii, 7–8, pp. 221–229, 1937.

In 1936 maize growing in the vicinity of Milan was again attacked, with increasing severity, by *Aplanobacter stewarti* [*R.A.M.*, xv, p. 573] (or at any rate by an organism very probably identical with this

species), the losses ranging from not less than 40 up to 90 per cent. of the crop. Apparently, the disease has been present but unnoticed for some years, having been brought in on seed from America.

Inoculation tests were carried out with four strains of the organism isolated from diseased plants on Pignoletto maize seedlings wounded in the collar and on the leaves, and grown in the laboratory in pots kept moist and at temperatures ranging from 10° C. at night to 20° by day. In all cases typical symptoms developed immediately after the unfolding of the third or fourth leaf. When a few plants of Rosso Siculo sorghum were similarly inoculated they remained apparently healthy, but the organism was reisolated from them in an active condition.

MATSUMOTO (T.) & OKABE (N.). **Preliminary note on the bacteriophage for Bacterium citri (Hasse) Doidge.**—*Agric. Hortic.* [*Japan*], xii, 8, pp. 2055–2059, 1 fig., 1937. [Japanese, with English summary.]

From the soil in which citrus plants infected with *Bacterium* [*Pseudomonas*] *citri* were growing, and on one occasion from infected leaves, the authors isolated the bacteriophage for the organism [cf. *R.A.M.*, xv, p. 395]. It was highly specific, being unable to attack any one of 19 different species of bacterium other than *P. citri*. The multiplication of the lytic principle was more abundant in potato dextrose solution than beef extract, and appeared to be greatest at 30° C.

RUEHLE (G. D.). **A strain of Alternaria citri Ellis and Pierce causing a leaf spot of rough Lemon in Florida.**—*Phytopathology*, xxvii, 8, pp. 863–865, 1 fig., 1937.

During 1936 and 1937 a leaf spot of rough lemons (*Citrus limonia*), similar to that described by Ethel M. Doidge from South Africa as due to *Alternaria citri* [*R.A.M.*, xvi, p. 601], was observed to be causing extensive defoliation in Dade County, Florida, where the lesions were occupied by a species of *Alternaria* frequently associated with *Colletotrichum gloeosporioides* [ibid., xvi, pp. 599, 601, *et passim*], the latter predominating in mixed infections. The irregular, light to dark brown lesions, the margins of which are typically darker than the centres, do not usually exceed 2 cm. in diameter unless secondary *Colletotrichum* infection is present. In cases of multiple infections the whole leaf blade becomes chlorotic, tending to curl upwards and drop prematurely, but where there are only one or two spots the dead areas may weather away, leaving jagged holes. The spores of the *Alternaria* formed in profusion on the leaves are obclavate and elongated, fuscous, 40 to 70 by 12 to 20 μ, tapering upwards into a narrow, subhyaline beak, 7 to 35 μ in length, and are provided with 3 to 9 (usually 6 or 7) transverse septa. A comparison of the leaf-spotting *Alternaria* with *A. citri* from fruit rot revealed the essential similarity of the two forms. In cross-inoculation experiments on rough lemons and Rangpur limes the fruit rot strain failed to infect the leaves, while the leaf-spotting form of *A. citri*, though able to cause fruit rot of oranges and lemons, did not sporulate in the diseased tissues. Bordeaux mixture has given satisfactory control.

Takimoto (S.). **Defoliation or rot disease of the Satsuma Orange.**—*Studia citrol.*, vii, 2, pp. 176–184, 5 figs., 1936. [Japanese, with English summary. Received November, 1937.]

Inoculation experiments are stated to have proved that *Gloeosporium foliicolum* [*R.A.M.*, iii, p. 133; xii, p. 396] in Japan is a weak parasite causing secondary infection of sunburnt Wase Satsuma orange [*Citrus nobilis* var. *unshiu*] fruits and the leaves of trees of the same variety debilitated by winter injury, defective soil, malnutrition, spray injury, and certain unknown causes. *Gloeosporium* spp. isolated from this host are not always morphologically similar, but they always resemble each other in pathogenicity.

Mould in Citrus fruits. Suggestions for control.—*J. Dep. Agric. Vict.*, xxxv, 6, pp. 261–269, 7 figs., 1937.

A survey made in 1935 of the citrus packing-houses in New South Wales, Victoria, and South Australia disclosed that the methods of handling the fruit and maintaining shed hygiene are responsible for wastage losses, chiefly caused by green and blue moulds (*Penicillium digitatum* and *P. italicum*) [*R.A.M.*, x, p. 517; xvi, p. 233]. The conditions requisite for infection are (1) rind injury, (2) the presence of the mould spores in the atmosphere, and (3) storage environment suitable for rot development. These factors should be eliminated as far as possible.

The procedure that should be adopted to avoid rind injury during picking and in the packing-shed is described in detail. The practice of laying the picking-boxes on the ground before picking is liable to introduce soil into them, and it is recommended that they should be placed on two lengths of timber. The hopper into which the fruit is tipped in the packing-house should be maintained in good repair, so that the nails holding the covering material in place are not exposed, and it is suggested that the floor of the hopper should consist of parallel steel bars covered with rubber. Dry brushes are liable to injure the fruits, and should be sprayed five minutes before scrubbing is begun. Drying in an air-tunnel is more hygienic than towelling. Wounding in the moving conveyor may be eliminated by the regular sandpapering of roughened surfaces, or by the provision of a rubber flap along the sides of the conveyor.

The reduction of sources of contamination may be effected by the periodic collection and destruction of mouldy fruits in the orchard, spraying the picking-gloves and aprons with chlorine solution (10 parts available chlorine per million) at the end of the day, steam sterilization of the picking-boxes, sweating the fruit in the grove, not in the packing-shed, the avoidance of introducing even a single mouldy fruit into the packing-plant, the strict disposal of waste fruits, and washing the floors and plant nightly with 0·5 per cent. caustic soda.

The development of mould in storage largely depends on temperature, ample moisture for spore germination being supplied by the orange itself. R. G. Tomkins has shown that at 75° F. an infection spot will reach 1 in. in diameter in 3 days, whereas at 40° it requires 30 days to do this. These figures explain in part why waste is more prevalent in

late than early Washington Navel oranges. This temperature factor, however, cannot be controlled without the provision of cool storage.

[This report, issued by the Citrus Preservation Technical Committee, composed of representatives of the Departments of Agriculture of New South Wales, Victoria, and South Australia, and the Council for Scientific and Industrial Research, also appears in *Fruit World, Melbourne*, xxxviii, 4, pp. 20–22; 5, pp. 12–13, 1937.]

Reichert (I.) & Littauer (F.). **A new method of control of wastage in Oranges.**—Reprinted from *Hadar*, x, 7–8, 13 pp., 2 figs., 1937.

A new method is described for controlling wastage from *Diplodia* stem-end rot [*D. natalensis*] and *Penicillium* mould [*P. digitatum* and *P. italicum* : *R.A.M.*, xvi, pp. 668, 744] on Palestinian oranges destined for export. It consists in dropping on to the stem end from a pipette one drop of a disinfectant. The best results were obtained with a solution known as 'iodine no. I', consisting of 13 gm. iodine, 10 gm. potassium iodide, 200 c.c. water, and 800 c.c. alcohol, which in a test in 1936 reduced *D. natalensis* in inoculated fruits stored for four weeks from 52 to 14·5 per cent.; in a further test in 1937 with uninoculated fruits it reduced *D. natalensis* from 2·3 to 0·7 per cent., and the *Penicillium* moulds from 8·7 to 0·4 per cent. The next best control was given by borax, which reduced the moulds from 8·7 to 0 per cent., and (in 1936) reduced *D. natalensis* from 52 to 29·5 per cent., after four weeks. In 1937, however, it failed to control *D. natalensis*.

Fawcett (H. S.). **Observations on Citrus conditions in Brazil.**—*Calif. Citrogr.*, xxii, 10, pp. 456, 459, 3 figs., 1937.

Most of the information given in this interesting account of the author's observations on the citrus industry of Brazil made during a five months' stay in the country has already been noticed from another source [*R.A.M.*, xvi, p. 603]. Leprosis is stated to be important in some localities of the State of São Paulo.

Bitancourt (A. A.) & Jenkins (Anna E.). **Variações de Elsinoe australis Bitancourt e Jenkins.** [Variations of *Elsinoe australis* Bitancourt & Jenkins.]—*Rodriguésia*, ii, Num. esp., pp. 315–317, 1 diag., 1937.

As illustrating the great variability in pure culture of *Elsinoe australis* [*R.A.M.*, xvi, p. 451], the authors state that a culture of the fungus isolated from Bahia orange (*Citrus sinensis*), while being subcultured on potato dextrose agar, produced a sector characterized by its velvety type of growth, which on further subculturing produced black, ash-coloured, red, and white sectors of the same type. When inoculated into and reisolated from a 'cravo' orange (*C. nobilis* var.) fruit, the same culture produced on potato dextrose agar velvety black, and red and white viscous sectors. The fact that when first reisolated from the 'cravo' orange the fungus did not differ in its type of growth from the original culture is considered to indicate that variation in the fungus is not induced by passage through different hosts.

REED (H. S.) & PARKER (E. R.). **Effects of zinc on growth.**—*Calif. Citrogr.*, xxii, 9, pp. 411–412, 1 graph, 1937.

To ascertain the effect produced on orange shoots by the application of the zinc spray used against mottle leaf [*R.A.M.*, xvi, p. 669] 30-year-old Valencia orange trees severely affected for many years were sprayed in March, 1934, with a mixture containing 10 lb. commercial zinc sulphate and 5 lb. hydrated lime per 100 galls. water. A few weeks later improvement was noted in the amount and character of the spring growth, and this improvement was maintained during the two following seasons, though the unsprayed controls were unthrifty and showed typical mottle. Other affected trees sprayed in October, 1934, showed normal growth the following spring.

The old, dwarfed leaves on the treated trees did not become normal in size or shape after spraying, but they produced chloroplasts and assumed a normal green colour. In May, 1935, many treated twigs showed the small, elliptical-lanceolate leaves characteristic of unsprayed, affected trees and normal green leaves of the 1934 growth cycle. The striking transition from dwarfed to normal leaves coincided with the production of the first cycle of growth after spraying, indicating that the zinc was quickly absorbed by the tree and rapidly affected the metabolism of the affected organs. The profound improvement in growth is also shown by the longer shoot growth, greater distance between the leaves, and the presence of blossoms. The xylem cylinder of twigs from sprayed trees averaged 518·5 and 716·4 μ for twigs 14 and 26 months old, respectively, as against 381·3 and 630·8 μ for unsprayed twigs of the same ages, respectively.

WARD (F. S.). **Deterioration of copra caused by bacteria and moulds.**—*Sci. Ser. Dep. Agric. S.S. & F.M.S.*, 20, pp. 95–108, 1937.

Fungi commonly present on copra in Malaya [*R.A.M.*, xiii, p. 216] are the *Aspergillus niger* group and its allies, *A. wentii*, *A. ochraceus*, *A. tamarii* and their allies, the *A. flavus-oryzae* group, *A. glaucus*, *Penicillium glaucum*, a Saccharomycete, and *Rhizopus* (? *nigricans*), while *Ceratostomella adiposa* [ibid., xiv, p. 274], *Trichothecium roseum*, and a species of *Colletotrichum* are occasionally present. Two species of rod-shaped bacteria are associated, separately and together, with the slime found on wet coco-nut during drying.

Certain moulds (e.g., *A. flavus*, *A. niger*, and *A. tamarii*) penetrate into the copra and cause more damage than others which grow on the surface. In inoculation experiments [which are described] *A. flavus* (sclerotia-producing) showed better penetration of coco-nut meat not exposed to bacterial action than either *A. niger* or *A. tamarii*, both of which made about equal progress. Inoculations with bacteria alone gave much less deterioration, while similar tests with *A. flavus* (sclerotia-producing) on copra already inoculated with bacteria indicated that continued bacterial action inhibited germination of the mould spores, though when the inoculations were made simultaneously the spores germinated and caused penetration.

In general, the *A. glaucus* group and *P. glaucum* were found to prefer a moisture content of about 7 per cent., while the *A. tamarii*, *A. wentii*

and *A. ochraceus* groups prefer one of about 12 per cent., and the *A. niger* group, *R.* (? *nigricans*), and *C. adiposa* one between 15 and 20 per cent. The sclerotial form of *A. flavus* appears to be the most important species found on copra owing to its tolerance of a wide moisture range, ranging from 7 to 15 per cent., with an optimum between 12 and 15 per cent.

Prepared copra deteriorated rapidly under the combined action of bacteria and penetrating moulds (chiefly *A. flavus*) when the moisture content of the copra was over 12 per cent. and room humidity and temperature over 80 per cent. and between 28° and 30°, respectively. Below 12 per cent. moisture *A. flavus* grew superficially but penetration of the tissues was limited to isolated areas where the bacteria had been able to establish themselves prior to fungus invasion. Under the same room conditions no bacterial development occurred on copra dried to 6 per cent. moisture content, while slight bacterial development was artificially produced on copra with a moisture content between 6 and 8 per cent. at room temperature under 43° and humidity over 80 per cent.

The bacteria causing copra deterioration appear able to remain dormant indefinitely on copra of 6 to 8 per cent. moisture content, under ordinary local conditions of temperature and humidity. The same applies to some of the penetrating moulds, such as *A. flavus* and *A. niger*, which by producing sclerotia resist adverse conditions indefinitely. These sclerotia did not develop on copra of 6 to 8 per cent. moisture content, even when moistened or kept in a humid atmosphere, though *A. glaucus* grew on copra kept under similar conditions.

The classification of copra moulds on a colour basis is unreliable, one colour sometimes including more than one species.

Bliss (D. E.). **The spread of decline disease in Date Palms.**—*Fourteenth Rep. Date Grs' Inst.*, pp. 4–8, 1937.

Since 1921 the number of date palms affected with decline disease associated with species of *Omphalia* [*R.A.M.*, xv, p. 15] in California has increased from one to approximately 800, the disease now being present in 21 gardens in Coachella Valley and one experimental planting at Riverside. Laboratory studies showed that the different strains of *Omphalia* associated with the disease belonged to two groups or species, technical descriptions of which are being prepared for publication elsewhere. These fungi are able to exist indefinitely as saprophytes on organic matter and are possessed of remarkable longevity under conditions unfavourable to growth. Either one or other of the two species have been found in 14 different gardens and they are regarded as the specific causal organisms of the decline disease. Root specimens from 21 palms surrounding an affected area showed *Omphalia* present in 9 of the palms, 7 of which showed no external symptoms. Thus a diseased area of 13 visibly affected palms actually included 20 affected palms when laboratory diagnosis was applied. This result indicates that the first phase of the disease is confined to the roots, injury to which may be far advanced before the aerial parts show any signs of infection.

The spores of the two species do not appear to play an important part in dissemination. The results of a transplanting experiment are

considered to show that the disease is transmitted on offshoots from diseased palms, while detached portions of affected palms appear to be potential carriers of the disease. Rhizomorphs were noted on the surface of the roots, though as yet there is no actual proof that they spread from one palm to another; apparently the mycelium grows through the soil. Progress of the disease appears to be favoured by those environmental conditions favouring the commercial production of the fruit. Five years are tentatively regarded as the period necessary after inoculation for the development of characteristic symptoms.

The highly susceptible Deglet Noor palm now represents approximately 90 per cent. of the 3,200 acres of commercial plantings in Coachella Valley. Only slight losses have been caused so far, taking the affected area as a whole, the affected palms amounting to about 0·5 per cent. of the total acreage; in certain gardens, however, where the disease has been present for ten years at least, injury has lately increased so rapidly as to have assumed major importance.

It is suggested that further spread may be checked by soil disinfection [loc. cit.], and the use of healthy offshoots only for planting. Control by means of soil disinfection is rather expensive and does not prevent reinfestation, but it is believed to be effective and to be well adapted for stamping out small areas of infection.

Bliss (D.). **Crosscuts in the fruitstalks of Date Palms.**—*Fourteenth Rep. Date Grs' Inst.*, pp. 8–11, 2 figs., 1937.

Date palms growing in California are affected by a condition, designated 'crosscut disease', in which the fruit stalks develop fractures near the point of attachment of the spadix to the trunk. The surrounding tissues are commonly invaded by fungi and bacteria but sometimes remain free from infection. Affected fruit stalks wilt and die, the time required for this process depending on the severity of the fracture. When severance is only partial, wilting and necrosis are gradual, the injury beginning at the distal end of the fruit strands and progressing backwards towards the fracture. Injury is most common between March and June, when fruit stalk elongation is most rapid and the fruits are the size and colour of peas.

In 1934 about 1,000 fruit bunches were lost as a result of crosscut disease in one garden, but losses since then have been small. In another garden the trouble has become progressively worse for seven years, and has repeatedly caused losses of fruit. Generally speaking, however, the disease is of little economic importance. The disease is most prevalent on the Sayer variety, but occurs occasionally on Dayri, Maktoom, Khadrawy, and Halawy.

Inoculations with a culture of a *Fusarium* species isolated from an affected stalk into artificial wounds in the leaf bases of a date palm showed it to be pathogenic, while other cultures of *Fusarium* from leaves and inflorescences were mildly pathogenic in wounded leaf tissue. The evidence is considered to suggest, however, that crosscuts are associated with structural weaknesses in the tissue, there being no indication that the fungi present will initiate such fractures as occur on the diseased trees. One inflorescence showed the presence of saucer-shaped cavities within the stalk.

In commercial plantings of the Sayer variety injury from crosscut is provided for by retaining an excess of fruit bunches, so that an adequate harvest may be secured.

MAYNE (W. W.). **Annual Report of the Coffee Scientific Officer, 1936–1937.**—*Bull. Mysore Coffee Exp. Sta.* 16, 15 pp., 1937.

Coffee sprayed against leaf disease [*Hemileia vastatrix*: *R.A.M.*, xv, p. 798] in Mysore during the hot season, 24, 38, 52, and 66 days after the blossom shower showed, respectively, 48·9, 56·1, 58·1, and 41·1 per cent. infection of the surviving leaves and 61·9, 56·7, 52·6, and 41·1 per cent. leaf survival. The non-cropping shoots showed similar though less well-marked effects from the different sprays, the second giving the best leaf survival. Taken as a whole the data indicate that it is less important to cover the maximum leaf area than to check the first increase in the disease after the blossom showers.

Laboratory studies showed that the endosperm of the coffee seed passes through a long rest period after fertilization, during which there is considerable growth activity in the nucellar tissues surrounding the fertilized embryo sac. These tissues develop and form a scaffolding within which the true endosperm develops. In this connexion it is pointed out that coffee black bean [ibid., xiv, p. 164] is associated with disturbances in the relation between the developing endosperm and the degenerating nucellar tissues, the condition resulting from abnormal activity in the latter.

From a die-back of the tops of young Robusta coffee trees [cf. ibid., xi, p. 636] a *Macrophoma* was isolated which all the evidence indicated as the cause of the disease, though this was not proved by inoculation tests. Infection appeared to have taken place through scars left during suckering. Only a few infections were noted during the wettest period of the south-west monsoon.

MAYNE (W. W.). **Factors affecting spray success in the control of Coffee leaf disease (Hemileia vastatrix B. and Br.).**—*Bull. Mysore Coffee Exp. Sta.* 15, 46 pp., 2 graphs, 1937.

A full account is given of a six years' study conducted at the Coffee Experiment Station, Mysore, of the principal factors, contributed by the host, the parasite, and the environment, governing the incidence of coffee leaf disease (*Hemileia vastatrix*) [see preceding abstract] in southern India, and of the relation of these to the problem of spraying.

The data obtained [which are tabulated and fully discussed] showed that there are locally two main periods of leaf development [*R.A.M.*, x, p. 239; xi, p. 368], one during the hot weather (March to May), when at least 60 per cent. of the total leaf growth is produced, and the other during the late north-east monsoon (mid-September to November). The disease becomes active as the hot-weather showers set in, usually about the middle of March, and the severity of the outbreak by the end of September depends on the start the disease has had and its rate of development during the hot weather. The chief source of inoculum lies in the diseased leaves which are carried through the dry season (December to February) and are present at the time of the blossom showers;

the other main factor affecting the start of the disease is the distribution and frequency of the rains in the hot weather. The amount of disease available at the end of the dry weather in unsprayed areas seems to be strongly affected by the length of the preceding drought, and the length of the drought from the end of the north-east rains until the blossom showers appears to be closely related to the subsequent severity of infection. The south-west monsoon (June to mid-September) exerts little influence on the disease.

Experimental evidence demonstrated that optimum protection of the leaves results (under local conditions) from spraying when they are not more than about one month old. If, however, the initial sources of the disease at blossom time are few, spraying may with advantage be delayed a little. The second (post-monsoon) spray is probably most effective when the outbreaks are mild and occur late. Successful control depends on (*a*) the reduction of the number of centres of infection carried through the dry weather, (*b*) the adjustment of spraying times to the times of leaf expansion and the suitable age of the maximum amount of leaf, and to the disease situation at blossom time or the end of August, and (*c*) the rapid completion of the spraying.

In an estate experiencing climatic conditions similar to those under which the above-mentioned observations were made the general procedure should be as follows. At the end of February the amount of leaf carried in the different fields should be noted, any area with a heavy head of leaf being presumed to carry many centres of infection. At blossom shower time the rainfall records must be carefully inspected to ascertain whether the dry period has been short or long, and this will indicate whether spraying can safely be delayed to increase the proportion of flush covered. If the conditions appear to favour infection, spraying should be begun not later than 25 to 30 days after the blossom shower, starting in the fields with the best-developed foliage. If the blossom shower is small and growth is delayed, spraying should also be delayed, and if the blossom shower is heavy, and growth starts vigorously, but the three weeks or so after the blossom shower are dry, then the spray may also be delayed somewhat. When the blossom shower is early a second spraying may be advisable, particularly if the weather just after the blossom showers is wet. In August, if infection is not severe, and the post-monsoon flush is marked, the second spray should be given as soon as possible, but when the disease is very severe and leaf growth is delayed, the second spray should be deferred until about a month after the new flush has become vigorous. The pre-monsoon spray should be applied earlier to areas carrying a large head of leaf through the dry weather and to sheltered areas, provided the trees are not more liable to black rot [*Corticium koleroga*] than to leaf disease, in which case they should be sprayed later. Areas carrying a small head of leaf through the dry weather, or where the disease usually appears late, should be sprayed later than others.

AZEVEDO (N.). **Relação bibliographica referente a fungos e doenças do Cafeeiro.** [Bibliographical references relating to the fungi and diseases of Coffee.]—*Rodriguésia*, ii, Num. esp., pp. 213–238, 1937.

In a brief foreword the author states that the great majority of the

papers on coffee diseases cited in this bibliography [comprising 217 titles] have been listed by him from the *Review of Applied Mycology* for the years 1925 to 1935, inclusive. Besides an alphabetical enumeration of the authors, the diseases are also listed in the alphabetical order of the Latin names of the causal organisms.

RUDIN (W.). **Topsterftebestrijding in de practijk, II.** [Top die-back control in practice, II.]—*Bergcultures*, xi, 23, pp. 847–849, 1937.

In connexion with the discussion which has been proceeding as to the most efficient method of combating top die-back of coffee [*Rhizoctonia* sp.] in the Dutch East Indies [*R.A.M.*, xvi, p. 798], the writer emphasizes the need for caution in pruning operations to avoid heavy losses of fruit-bearing wood and berries, especially in old, topped plantations where the coolies cannot easily distinguish between the injuries due to this disease and abnormalities resulting from other causes. It is suggested that the work of excision of infected material should be preceded by preliminary surveys, at intervals of 14 to 20 days, to ascertain the extent of the damage and prune diseased branches lightly, progressing gradually to more radical methods where indicated. In the case of young trees in the early stages of die-back, it is not advisable to cut the affected branches right down to the point of insertion on the stem, since in some cases at any rate infection will be confined to the periphery and readily eliminated by the removal of the tips.

VASUDEVA (R. S.). **Studies on the root-rot disease of Cotton in the Punjab. IV. The effect of certain factors influencing incidence of the disease.**—*Indian J. agric. Sci.*, vii, 4, pp. 575–587, 4 graphs, 1937.

Continuing his studies on cotton root rot (provisionally attributed to *Rhizoctonia bataticola*) [? *Macrophomina phaseoli*] and *R.* [*Corticium*] *solani* in the Punjab [*R.A.M.*, xvi, p. 672], the writer carried out a number of experiments on naturally or artificially infected soil to determine the influence of various factors on the incidence of the disease.

Four years' tests on the relation of watering to root rot in *Gossypium indicum* var. *mollisoni* (No. 15) showed a progressive decline in the percentage of infection with a reduction in the number of irrigations, the figures being particularly suggestive in 1933, when the percentages of root rot mortality with 5 and 2 irrigations were 32·39 and 22·78, respectively, and in 1935 (80·11 per cent. infection with 7 irrigations and 50·27 with 3). A close correlation was further established, on the basis both of field records and controlled greenhouse trials, between the amount of soil moisture and the extent of root rot. Both the fungi implicated caused heavy infection (up to 100 per cent.) at 15 and 20 per cent. soil moisture, whereas at 5 per cent. no pathological symptoms developed in the test plants. Late sowing (after the end of May) was found in experiments at Lyallpur and Khanewal to contribute to the reduction of root rot both in native and American cotton varieties, since the resultant stands escape the period of maximum virulence of the causal organisms. No root rot symptoms have been observed in the indigenous types of cotton in the non-irrigated areas, e.g., of the Ambala district, though the two fungi concerned were isolated from the roots of the plants. For some reason requiring further investigation

local conditions are unfavourable to the development of these organisms in an actively parasitic form. Some evidence was obtained that the application to the plots of farmyard manure at the rate of 1,000 maunds [37,327 kg.] per acre about a month before sowing exerted a beneficial action on the health of the plants, which was apparently not affected, however, by the method of sowing, namely, on ridges or flat.

PANSE (V. G.) & PATEL (A. F.). **A genetical study of roots in relation to disease-resistance in Cotton.**—*Indian J. agric. Sci.*, vii, 3, pp. 451–457, 1937.

To ascertain whether any genetical relationship exists between root characters and the incidence of root rot of Gujarat cottons (*Macrophomina*) [*phaseoli*: see preceding abstract] a rapid method of examining the roots was devised, in which the selected plants were profusely watered and next morning the roots gently dug out in stages (about 4 or 5 in. at a time), the soil being removed with the help of the hands, until the tap-root could be traced no farther. In this way two men exposed the roots of 35 to 40 plants per day. The characters studied were (1) the total length of the tap-root, (2) the diameter in the topmost and second region of 15 cm. length, and (3) the total number of laterals in regions one and two and the remaining portion. In this way, the root-rot resistance of selected cottons was compared with that of the susceptible variety Broach 9 as control. Two pairs of plants, each consisting of a plant of the strain being tested and a Broach 9 plant from the neighbouring row, were selected at random from each plot, and the character examined was recorded as an average difference per plot between the strain and the control, the latter value being subtracted from the former.

The [tabulated] results showed clearly that a long tap-root, profuse branching below 15 cm., and the presence of few laterals in the first 15 cm. of the soil are associated with root-rot resistance in the varieties studied, and that significant differences exist in these root characters between varieties with different degrees of susceptibility, and also between resistant and unselected plants of the same strain. This last result is regarded as of much practical importance to plant breeders and to justify the selection within a strain of single plants based on desirable root characters.

ROGERS (C. H.). **The effect of three- and four-year rotations on Cotton root-rot in the central Texas Blacklands.**—*J. Amer. Soc. Agron.*, xxix, 8, pp. 668–680, 5 diags., 1937.

Three-year rotation combinations of maize, oats, sorghum, or fallow with cotton were ineffectual against root rot of the last-named host (*Phymatotrichum omnivorum*) [*R.A.M.*, xvi, pp. 176, 672] in the Houston Blackland soils of central Texas from 1928 to 1936. Four-year rotations of cotton with maize, sorghum, oats, or wheat, however, resulted in a consistent reduction of infection, over 100 per cent. more of which occurred in the continuous than in the alternating stands. Small increases in lint yield were also obtained from cotton in three- and four-year rotations. A high early- or mid-season incidence of severe root rot causes marked yield decreases, but fair harvests may be secured in continuous cotton even in the presence of the disease pro-

vided the soil is fertile and attacks of the fungus are delayed until late in the season. The number and viability of the sclerotia, the primary means of propagation of *P. omnivorum*, were not reduced in the triennial rotations as compared with continuous cotton but declined markedly in the four-year alternation. Control of root rot should be based, in accordance with the foregoing data, on the exclusion of susceptible crops from the rotation for at least three years before replanting the land with cotton, and on measures, e.g., green manuring, calculated to enhance soil fertility.

ANDREWS (F. W.). **Investigations on black-arm disease of Cotton under field conditions. II. The effect of flooding infective Cotton débris.**—*Emp. J. exp. Agric.*, v, 19, pp. 204–218, 10 graphs, 1937.

This further paper on the author's investigations into the control of blackarm disease [*Bacterium malvacearum*: *R.A.M.*, xvi, p. 247] of cotton in the Gezira area of the Sudan gives an expanded account of work already noticed from other sources [ibid., xiv, p. 757; xvi, p. 173]. The results obtained are considered to justify the flooding of old cotton land, combined with later sowing, in small, severely infected areas.

KRUG (H. P.). **Fusarium como causador da murcha do Algodoeiro no Brasil.** [*Fusarium* causing Cotton wilt in Brazil.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 319–321, [1937].

The species of *Fusarium* causing cotton wilt in Brazil is stated to have been identified by H. W. Wollenweber as *F. vasinfectum* form 1 [cf. *R.A.M.*, xvi, p. 607].

BRUCKHAUS (W.). **Some common antiseptics for the prevention of mildew on Cotton goods.**—*Appreturztg*, xxviii, pp. 35–37, 1936. [German. Abs. in *Chem. Abstr.*, xxxi, 21, p. 8205, 1937.]

Sulphur dioxide, although effective against mildew [including *Aspergillus* and *Penicillium* spp.] in cotton materials [*R.A.M.*, xv, p. 790], must be rejected on account of its possible oxidation to sulphuric acid; lead, mercury, and arsenic compounds are inapplicable by reason of their poisonous character, while copper and iron sulphates are unsuitable because of their colour and sensitivity to alkalis. Aluminium salts are efficacious only at relatively high concentrations. Chromium and manganese compounds are strongly antiseptic but their high colour is again objectionable, while a similar drawback applies to picric acid. The odour of creosote precludes its use and tannin does not kill the mildew fungi. In the case of salicylic acid and its salts the neutral dressings used must be considered, as well as the action of these compounds on certain dyes. Formaldehyde and paraformaldehyde are used with good results, while the fungicidal action of chloramine is limited.

MÉTALNIKOV (S.). **Utilisation des spores dans la lutte contre les insectes nuisibles.** [The utilization of spores in the campaign against noxious insects.]—*C.R. Soc. Biol., Paris*, cxxv, 23, pp. 1020–1023, 1 fig., 1937.

After briefly summarizing the successful results of his work in the

control of maize, cotton, and kitchen-garden pests by means of the application of dried bacterial spore emulsions [*R.A.M.*, xv, p. 292], the writer refers to recent experiments in France in which a reduction of nearly 90 per cent. in the incidence of *Pyralis* [*Sparganothis pilleriana*] and *Cochylis* [*Clysia ambiguella*] on vines was obtained by similar methods, while all the Tortricid larvae on apple trees were destroyed by the treatment. The spores remain in an active state for many years and may be applied with the utmost facility.

DRECHSLER (C.). **Some Hyphomycetes that prey on free-living terricolous nematodes.**—*Mycologia*, xxix, 4, pp. 447–552, 18 pl., 1937.

This is a detailed and fully illustrated account of the author's studies in pure culture of 18 species of Hyphomycetes that prey on nematodes living free in the soil in the United States [cf. *R.A.M.*, xiv, p. 508; xv, p. 720], namely: *Arthrobotrys superba* Corda, *A. cladodes* n.sp., *A. oligospora* Fres., *A. conoides* n. sp., *A. musiformis* n.sp., *A. dactyloides* n.sp., *Dactylella bembicodes* n.sp., *D. ellipsospora* Grove, *D. asthenopaga* n.sp., *D. lysipaga* n.sp., *D. leptospora* n.sp., *D. gephyropaga* n.sp., *D. brochopaga* n.sp., *Dactylaria thaumasia* n.sp., *D. candida* (Nees) Sacc., *D. polycephala* n.sp., *Triposporina aphanopaga* n.sp., and *Trichothecium polybrochum* n.sp. English and Latin diagnoses of all the new species are appended. A description (with diagnoses) is also given of another new species of *Dactylella* (*D. tenuis*) which occasionally developed in old nematode-infested agar plate cultures, following the addition of leaf mould, and which was occasionally found parasitizing oospores of *Pythium butleri* and *P. ultimum*, but was not seen to attack nematodes.

KATSURA (S. K.) & JOHNSON (A. G.). **The green muscardine fungus on the periodical Cicada.**—*Science*, N.S., lxxxvi, 2223, p. 128, 1937.

Nymphs of the periodical cicada (*Magicicada septendecim*) in Maryland were found in May, 1936, to be covered with a creamy-white mycelium which made profuse growth on potato dextrose and nutrient beef agar, subsequently sporulating abundantly (also on rice kernels and on diseased insects in Petri dish moist chambers). The olive-green spores measured 7·8 to 12·8 by 1·8 to 4·5 μ (mostly 9·7 to 11·3 by 3 to 3·8 μ) and are thus apparently referable to the long-spored form (f. *major*) of *Metarrhizium anisopliae* [*R.A.M.*, xvi, pp. 37, 153]. Healthy nymphs and adults were successfully inoculated with spores of the fungus which was readily reisolated; the nymphs were more susceptible than the adults, on which the organism did not sporulate.

SHAHAN (M. S.). **A dermatomycosis of Guinea-pigs.**—*Arch. Derm. Syph., Chicago*, xxxvi, 2, pp. 335–341, 4 figs., 1937.

Particulars are given of an epidemic of dermatomycosis among laboratory guinea-pigs, caused by a fungus tentatively referred by Vera K. Charles to *Achorion gypseum* [*R.A.M.*, xvi, p. 101].

DAVIS (C. L.), STILES (G. W.), & MCGREGOR (A. N.). **Pulmonary coccidioidal granuloma. A new site of infection in cattle.**—*J. Amer. vet. med. Ass.*, xci, 2, pp. 209–215, 3 figs., 1937.

From 1918 to 1935 twenty-two cases of coccidioidal granuloma

(*Coccidioides immitis*) [*R.A.M.*, xvi, p. 745] were reported in animals in the United States, all except two originating in California [ibid., xv, p. 221]. During these years there was no marked increase in the incidence of the disease in animals, but from 1st June, 1931, to 1st July, 1936, the number of human cases rose from 264 to 450, of which 224 were fatal. The present paper deals with the detection of the fungus in two lots of Herefords in May, 1937, 42 out of 128 being affected in the first and 5 out of 61 in the second lot. The tissues involved were the mediastinal and bronchial lymph nodes and the lungs, the last-named being here recorded for the first time as a site of infection in livestock. The fungus occurred *in situ* exclusively in the spherical form, frequently enclosed in giant cells. On meat infusion agar at 37° C. white, cottony colonies were formed.

Alfonso y Armenteros (J.) & Hernandez (A.). **Tinea of the scalp in Cuba.**—*Urol. cutan. Rev.*, xli, 6, pp. 448–453, 8 figs., 1937.

The writers summarize their etiological, mycological, clinical, and therapeutic observations on tinea of the scalp in Cuba, where 90 to 95 per cent. of the cases, as in other Latin-American countries, are associated with *Microsporon felineum* [*R.A.M.*, xvi, pp. 383, 810].

Berde (K. v.). **Eine neue Abart der Trichophyton gypseum-Gruppe: Trichophyton gypseum subfuscum.** [A new variety of the *Trichophyton gypseum* group: *Trichophyton gypseum subfuscum*.]—*Arch. Derm. Syph., Berl.*, clxxvi, 1, pp. 1–4, 3 figs., 1937.

In 1929, and again during the past few years, the writer isolated from the skin of persons coming into contact with domestic animals in Hungary a new variety of *Trichophyton gypseum*, named *subfuscum*, differing from the type in the production on standard media of yellow to brown colonies in which the characteristic radial grooves are replaced by a concentric development.

Lecoulant (P.). **Kérion de Celse dû à Microsporon gypseum atypique (complément d'étude).** [Kerion celsi due to an atypical *Microsporon gypseum* (completion of study).]—*Ann. Derm. Syph., Paris*, Sér. V, viii, 8, pp. 638–646, 7 figs., 1937.

Supplementary data are presented on an atypical form of *Microsporon* [*Trichophyton*] *gypseum*, previously described (*Ann. Derm. Syph., Paris*, v, p. 760, 1934; *J. Méd. Bordeaux*, [cxii], p. 462, 1935) as *M. g. burdigalense*. In the case under discussion the fungus was responsible for kerion celsi in a four-year-old girl, while in the three previously reported it assumed the form of circinate herpes. On Sabouraud's agar the colonies grow rapidly and by the 15th day a powdery coating is formed with an acuminate centre and radial periphery, the colour of unbleached linen or chamois leather. On a glass slide the spindles germinate rapidly, giving rise to vigorous colonies covered with a powdery coating composed of a mass of spindles borne at the hyphal tips. Scattered aleuria may be present, especially in old cultures. The radial grooves, central hollow, and peripheral protuberances typical of *T. gypseum* are entirely absent.

Downing (J. G.), Nye (R. N.), & Cousins (S. M.). **Investigation of the fungous flora of apparently normal skins.**—*Arch. Derm. Syph., Chicago*, xxxv, 6, pp. 1087–1092, 1937.

Among the organisms isolated from three sites—behind the ears, the corners of the mouth, and between the toes—in 100 persons with apparently normal skin were *Epidermophyton floccosum* and *Trichophyton mentagrophytes*, besides a number of species, mostly unidentified, of various other genera.

Langeron (M.). **Nouvelles observations statistiques et mycologiques sur les teignes humaines au Maroc.** [New statistical and mycological observations on human ringworms in Morocco.]—*C.R. Acad. Sci., Paris*, ccv, 8, pp. 422–424, 1937.

The writer, having now completed his studies on 1,746 isolations of ringworm fungi from 3,000 children in western French Morocco, a preliminary note on which has already appeared [*R.A.M.*, xvi, p. 458], gives further particulars as to the geographical distribution of the species encountered, namely, *Trichophyton violaceum*, *T. glabrum*, *Achorion schoenleini*, *A. milochevitchi*, *A. debueni*, *A. brumpti*, *A. pittalugai*, and *A. talicei*. On the one hand, the well-marked association of certain species with given localities appears to be correlated with the physical geography of the region (maritime and mountain influences), and on the other with the ethnographical attributes of the native populations in the various districts surveyed.

Fujii (S.). **Beiträge zur Studie des Pilzerregers von Parau-Tamushi Takasugi und Ponape-Tamushi Takasaki.** [Contributions to the study of the fungal agent of parau-tamushi Takasugi and ponape-tamushi Takasaki.]—*Jap. J. Derm. Urol.*, xlii, 2, pp. 49–53, 8 figs., 1937.

A fungus isolated by Dr. Iseki from four cases of the forms of dermatosis known in Japan as 'ponape-' or 'parau-tamushi' (*Acta derm., Kyoto*, xxiv, 4, 1934) was identified, on the basis of its cultural and morphological characters, as *Sabouraudites ruber* [*Trichophyton rubrum*: *R.A.M.*, xvi, p. 675]. The clavate or piriform spores of the fungus measure 4 to 5 by 2 to 3 μ or 15 by 10 μ (the latter situated on the lateral branches), the 4- to 5-septate spindles 30 to 50 by 15 to 20 μ, and the chlamydospores 10 to 20 μ; 'comb tooth' elements are sparsely produced.

Pisacane (C.). **Contributo allo studio delle epidermomicosi acromizzanti.** [A contribution to the study of the decolorizing epidermomycoses.] —*Boll. Sez. reg.* (*Suppl. G. ital. Derm. Sif.*), xv, 2, pp. 190–191, 1937.

Most of the 20 cases of the decolorizing form of pityriasis versicolor investigated by the author in Italy of recent years were due to *Microsporon* [*Malassezia*] *furfur* [*R.A.M.*, xvi, pp. 316, 456], but in one instance *Hemispora stellata* [ibid., xvi, p. 385] was isolated from the infected skin.

REPETTO (E.). **Ricerche sperimentali sulle lesioni della vescica da ifomiceti.** [Experimental studies on bladder lesions due to Hyphomycetes.]—*Arch. ital. Chir.*, xlv, 2, pp. 101–128, 14 figs., 1937.

In experimental inoculations with *Mycotorula zeylanoides* Red. & Cif. [*R.A.M.*, xiv, p. 582] and *M. verticillata* Red. & Cif., isolated in Italy from tonsillar and pharyngeal lesions and from erythemato-desquamating dermatitis, respectively, on 24 rabbits through various channels only six developed nodular-granulomatous lesions of the bladder directly attributable to these organisms, and in four of the affected animals the injections were made directly into the bladder. It would thus appear that the bladder possesses a considerable degree of natural resistance to fungal invasion.

BALDACCI (E.). **Revisione delle specie di Corethropsis e Paecilomyces isolate dall'uomo.** [A revision of the species of *Corethropsis* and *Paecilomyces* isolated from man.]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, x, 25 pp., 14 figs., 1937. [Latin and English summaries.]

After reviewing the literature of the genus *Corethropsis* the author describes his studies on the cultural and morphological characters of *C. hominis* (Vuillemin's strain) [*R.A.M.*, ix, p. 244], *C. hominis* var. *sphaeroconidica* Cif. & Bald., and *C. puntonii* Vuill., as a result of which he retains the first two in *Corethropsis*, but confirms the transference of the third to *Paecilomyces* as *P. puntonii* (Vuill.) Nannizzi. The genus *Corethropsis* in the sense attributed to it by Corda includes heterogeneous species and the author would accordingly segregate the synnematous stilbaceous forms as *Gibellula*, the type species being *G. pulcra*, and leave the non-synnematous forms belonging to the Mucedinaceae in *Corethropsis* [Corda emend.] Sacc. emend. Vuill., the type species being *C. hominis* Vuill. The paper concludes with revised diagnoses in Latin of the genera *Gibellula*, *Corethropsis*, and *Paecilomyces*.

GREENBURG (W.). **Sporotrichosis: report of a case in California.**—*Arch. Derm. Syph., Chicago*, xxxvi, 2, pp. 355–357, 1 fig., 1937.

A pleomorphic species of *Sporotrichum*, presenting in culture the characters both of *S. schenckii* [*R.A.M.*, xvi, p. 608] and *S. beurmanni* [ibid., xvi, p. 254], according to the site of isolation, was found to be responsible for a deep, granulating, indurated ulcer on the median finger of the right hand of a six-year-old Mexican girl in California.

VALENTINE (G. M.). **Mould penetration in New Zealand cheese.**—*N.Z. J. Agric.*, lv, 2, pp. 89–99, 1937.

A brief account is given of experiments which were made to determine the causes of the development inside New Zealand cheese of mould [? *Penicillium*] seams, a defect which in 1936 brought a number of complaints and claims for refunds from English importers of the produce. The results indicated that rough handling of the cheese in storage or transit is not responsible for the condition, and that the mould seams develop chiefly in cheeses with defective rinds in atmospheres favourable to the development of the organisms. The trouble may be avoided by improving the conditions in the curing-room, especially as regards ventilation.

Ocfemia (G. O.). **The Abacá-disease situation in Davao.**—*Philipp. Agric.*, xxvi, 3, pp. 229–236, 2 figs., 1937.

As a result of his visit of investigation to the abacá [*Musa textilis*] plantations in Davao, Philippine Islands, where a suspected 'new' disease of the crop occasioned alarm in the early part of 1937, the writer concludes that the trouble is of complex origin, due to the combined effects of a disease resembling banana wilt (*Fusarium oxysporum* f. 3) [*F. oxysporum cubense*: *R.A.M.*, ix, p. 785], stem weevil (*Odoiporus* sp.) invasion, and other obscure factors. The wilt-like disease is destructive only at high altitudes where the insect is abundant. Bunchy top [ibid., xv, p. 80] is an important disease in the locality and is further aggravated by a disorder resembling mosaic [ibid., xiv, p. 811], the possible connexion of which with a similar mottling of *Canna indica* is under investigation.

Uppal (B. N.) & Kulkarni (N. T.). **Studies in Fusarium wilt of Sann-Hemp. I. The physiology and biology of Fusarium vasinfectum Atk.**—*Indian J. agric. Sci.*, vii, 3, pp. 413–442, 1 graph, 1937.

A detailed study [which is fully described] of the wilt disease of sann-hemp (*Crotalaria juncea*) caused by *Fusarium vasinfectum* [*R.A.M.*, xv, pp. 482, 771] in the region of the Bombay-Deccan canals showed that the disease is widespread, that it greatly reduces the yield of green dressing per acre, and consequently is a serious menace to sugar-cane cultivation by the Manjri standard method in which sann-hemp and cotton form a normal rotation.

The first symptom in the field consists of a yellowing of the oldest leaves, which proceeds upwards, the vascular tissue of the petiole at the same time turning brown. Young seedlings, if infected, may die within a few hours of emergence, older plants collapsing in two to three weeks. Wilting is very rapid in September and October, but gradual in June and July.

Isolations of *F. vasinfectum* from wilted sann-hemp in widely separated localities in Bombay were almost equally pathogenic to sann-hemp. The best vegetative growth of the fungus in culture occurred at 25° to 30° C., and the disease also showed maximum development at a similar soil temperature range. Infection was very destructive in soil with a low moisture content (15 per cent.), but as soil moisture does not vary widely under normal field conditions during the monsoon soil temperature is generally the limiting factor determining severity. On sann-hemp the fungus produced emulsin, lipase, erepsin, trypsin, and amidase, but was unable to utilize cellulose or starch. In media containing inorganic nitrogen the fungus reduced nitrates to nitrites, but such action was not noted in media with organic nitrogen. The filtrates of 24- to 28-day-old cultures on Richards's solution contained 0·0015 to 0·0022 mg. of nitrite nitrogen per c.c. of solution, and possessed toxic qualities which were not destroyed by boiling.

In cross-inoculation experiments infection was transferred from *C. juncea* to *C. anagyroides*, *C. striata*, and *C. usaramoensis* but not to pigeon pea (*Cajanus indicus*) [*C. cajan*] or cotton. Experimental evidence showed that the disease in sann-hemp is seed-borne, generally

externally, though a small percentage of the seed may carry internal infection as dormant mycelium (118 seedlings from 8,786 seeds sown showed internal browning and *F. vasinfectum* was recovered from the discoloured portions). Infection of pods from peduncles often results in retarded development; seeds formed in such pods often carry infection internally, and are an important source of transmission.

MITRA (M.). **An anthracnose disease of Sann-Hemp.**—*Indian J. agric. Sci.*, vii, 3, pp. 443–449, 4 pl., 1937.

An account is given of the author's studies of the serious anthracnose of sann-hemp [*Crotalaria juncea*] seedlings, which was first noticed in 1935 in Pusa in fields sown during August, when the weather was constantly wet and cloudy, and especially in thickly sown stands. Infection usually occurred on the cotyledons, from which it spread to the stem and growing point, the young seedlings generally dying when the latter was reached. In plants infected at a later stage of growth, the disease was restricted to spots on the leaves and stems, and the plants for the most part recovered on the onset of dry and bright weather. Isolations yielded a fungus which was grown in pure culture and identified as a strain of *Colletotrichum curvatum* [*R.A.M.*, xv, p. 703]. Infection experiments showed that it is very virulent to *Crotalaria juncea* seedlings, especially if sown late when the weather is moist and cloudy. Further pot experiments indicated that disinfection of both naturally and artificially infected seed with 0·25 per cent. uspulun for 30 minutes completely controlled the disease, and that spraying the seedlings in dry weather before infection with 0·5 per cent. Bordeaux mixture, 1 per cent. Burgundy mixture, or 1 in 10,000 malachite green solution plus 0·1 per cent. agral, was effective in reducing the percentage of infection and retarding the attack by the fungus.

BENATAR (R.). **Contribução ao estudo bibliographico de doenças da Roseira.** [Contribution to the bibliographical study of the diseases of the Rose.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 239–264, [1937].

This paper is divided into two parts, the first of which consists of an alphabetical index of 278 species of fungi and three species of bacteria recorded on the rose, with citations, and the second part comprises a list of 168 papers relating to the rose diseases, arranged alphabetically under the authors' names.

McWHORTER (F. P.). **A latent virus of Lily.**—*Science*, N.S., lxxxvi, 2225, p. 179, 1937.

The occurrence of a 'latent' virus in lilies (*Lilium tigrinum*, *L. candidum*, and *L. longiflorum*) is reported from Oregon. The infective principle is apparently identical with the colour-removing tulip virus 1 [*R.A.M.*, xii, p. 292] which plays the leading part in the complex disturbance known as 'breaking' [ibid., xv, p. 724] and is believed to date back to 1576 (*Nat. hort. Mag.*, xii, p. 179, 1933). Inoculations during the past three years from externally sound bulb-perpetuated lilies to Clara Butt and other tulip varieties have induced extreme forms of breaking. Tulips have, in fact, proved to be remarkably

efficient test plants for determining the presence of viruses in *L.* spp. The juice from seedlings of the fertile *L. longiflorum* was found not to contain the latent virus, and bulb-perpetuated lilies should, therefore, not be planted among choice seedling varieties. These facts, which are to be further elaborated in a forthcoming paper, may necessitate a reconsideration of tulip breaking as the oldest known virus disease, since it is by no means impossible that the wild or semi-wild tulips introduced into Europe from Turkestan were healthy until exposed to infection from Madonna lilies in Italian gardens.

Gregory (P. H.). **Narcissus leaf diseases.**—*Daffodil Yearb., 1937*, pp. 46–52, 4 pl., 1937.

Popular notes, designed to assist growers, are given on the symptoms and control of the following common leaf diseases of narcissus in Great Britain. Scorch (*Stagonospora curtisii*) [*R.A.M.*, xiv, p. 366; xv, p. 298] is widely prevalent and is an important cause of spotted, spoiled flowers in localities where flowering occurs early. The fungus appears to be carried on the nose of the bulb [ibid., xiii, p. 167] where overwintered spores infect the new, emerging shoot. The disease can occur in newly planted stocks, but generally its severity is increased after the first year. The Trumpet and Incomparabilis forms remain comparatively free from epidemic infection on the foliage and from flower-spotting. Among the most susceptible varieties in early-flowering districts in south-western England are Soleil d'Or, Scilly White, Grand Primo, Bath's Flame, Cheerfulness, and Horace. A wet growing season and excessive applications of nitrogenous manures increase attack on the foliage and flowers. Copper sprays check spread from the infected leaf tips, but the best control results from picking these off as early as possible.

White mould (*Ramularia vallisumbrosae*) [ibid., xvi, p. 319] first appears in Cornwall and the Scilly Isles on the Golden Spur variety, which acts as a reservoir of infection for other varieties. Narcissus fire (*Botrytis polyblastis*) [ibid., xiv, p. 637] occurs irregularly, except in the south-west where it causes spotting and decay of the flowers in wet weather and, later, rapid destruction of the foliage. It does not produce bulb rot. The varieties worst affected early in the season are those of *N*[*arcissus*] *tazetta* parentage, especially Soleil d'Or, but incidence is also very general on Trumpet varieties. Control consists in preventive applications of Bordeaux mixture and the destruction of diseased foliage. Grey mould or smoulder (*B. narcissicola*) [ibid., xiv, p. 366] is widely distributed and produces rapid rotting of the perianth in early districts, epidemics on the foliage in cold, wet seasons, and rotting of stored bulbs in cool summers.

Stripe, grey disease, or mosaic (variously applied to one or more mosaic-like conditions) [ibid., xv, p. 444] is common on most cultivated varieties of narcissus, few stocks, probably, being completely free from it, while in some varieties nearly every plant may be affected. A perennial disease in the bulb, it usually spreads slowly through the stock in a manner at present imperfectly understood. Many varieties are only slightly affected, but in others it seriously reduces plant vigour. The streaks vary from dark grey-green to yellow-green, and in some varieties, such as Minister Talma, to bright yellow. Stripes are common in

the perianth also. It sometimes causes an overgrowth of the cells, with resultant roughening of the leaf surface, a condition always present in striped Czarina plants. The only control method known is roguing.

Foliage wilt in bright weather is often a sign of root rot, due, presumably, to insufficiency of the root systems. Grassiness, i.e., the presence of numerous narrow leaves, is a symptom of excessive splitting of the bulb, usually following injury to the basal plate, probably caused by narcissus fly [*Merodon equestris* and *Eumerus* spp.] and bulb-rotting fungi.

MURPHY (P. A.). **Irish Free State: a new outbreak of Peronospora antirrhini in the country.**—*Int. Bull. Pl. Prot.*, xi, 8, p. 176, 1937.

The author states that 50,000 *Antirrhinum majus* plants were destroyed in 1936 in a nursery at Carlow, Ireland, by an outbreak of *Peronospora antirrhini* [*R.A.M.*, xvi, p. 815], and that, in spite of the steps that were taken immediately to eradicate the disease, it again appeared on a few plants in that nursery towards the end of the 1937 season. The first symptom is the appearance of indefinite pale areas on the leaves, bearing a fine, almost invisible whitish mildew on the lower surface; in most cases, the growing points of the seedlings are killed back, and the lower leaves then wither from the tip backwards. The conidiophores of *P. antirrhini* are 250 μ high, and bear hyaline, oval conidia, 26 by 17·5 μ. The fungus survives by means of resting spores, 30 μ in diameter, which are formed in the leaves. There was evidence that, if the disease is controlled during the seedling stage, the plants may grow and flower almost normally.

NICOLAS (G.) & AGGÉRY [BERTHE]. **Une maladie bactérienne d'Aucuba japonica Thunb.** [A bacterial disease of *Aucuba japonica* Thunb.]—*Bull. Soc. Hist. nat. Toulouse*, lxx, pp. 267–272, 3 figs., 1936. [Received 1937.]

Since 1932 *Aucuba japonica* plants at the Toulouse Faculty of Sciences have been affected by a disease involving stunting, malformation, a yellowish discoloration, and a brown to black spotting of the tips and edges or the entire surface of the leaves, some of which may be completely shrivelled and adhere to the branches. The floral bunches do not expand and the flowers remain in the bud stage and wither before opening. Diseased leaves are frequently blistered and abnormally thick, the young ones containing an abundance of starch. From the juice of diseased leaves a rod-shaped, Gram-positive bacterium was isolated, measuring 6 to 7 by 2 to 2·5 μ and forming creamy-white, stellate colonies; gelatine was not liquefied. The organism has not yet been studied systematically, but is obviously distinct from *Pseudomonas aucubicola* associated with a disease of *A. japonica* in Scotland [*R.A.M.*, xv, p. 510].

OBEE (D. J.). **A note on the canker disease of Gardenias.**—*Trans. Kans. Acad. Sci.*, xxxix (1936), pp. 103–104, 1937.

A species of *Phomopsis* with a floccose, concentric mycelium, fairly large pycnidia, and elliptical-ovoid spores, has been isolated from gardenias in a greenhouse at Kansas University. The fungus would

appear to be distinct from those isolated, respectively, by Hansen and Scott in California and by Tilford in Ohio [*R.A.M.*, xvi, p. 614]. The Kansas strain produces corrugated cankers, originating as greenish-brown spots, on the stems which are entirely girdled. The leaves of affected plants turn yellow and shrivel and commonly fall, while the flower buds are frequently shed before opening. Of the three varieties under observation, Californiae is the most susceptible, followed by Belmont, while Veitchii is comparatively resistant. The spread of infection may be arrested by painting the stems of the healthy plants with semesan at 10- to 14-day intervals.

CHESTER (F. D.). **A bacterial disease of Delphinium.**—*Phytopathology*, xxvii, 8, pp. 855–858, 1937.

A full description is given of the morphological, cultural, and physiological characters of *Erwinia phytophthora*, which has been identified as the agent of the bacterial disease of *Delphinium ajacis* described by B. O. Dodge from the New York Botanic Garden [*R.A.M.*, xv, p. 229]. Inoculations with the organism on healthy plants gave positive results.

GILL (G. A.). **Diseases of Lucerne.**—*Bull. Dep. Agric. S. Afr.* 170, pp. 81–83, 1936. [Received November, 1937.]

Notes are given on the following diseases of lucerne in South Africa, viz., rust (*Uromyces striatus*) [*R.A.M.*, xvi, p. 754], leaf spot (*Pseudopeziza medicaginis*) [ibid., xiv, p. 424], anthracnose (*Colletotrichum trifolii*) [ibid., xiii, p. 773; xvi, p. 540], downy mildew (*Peronospora trifoliorum*) [ibid., xv, p. 373], crown rot (*Fusarium* sp.) [cf. ibid., xv, p. 158], grey mould due to *Physarum cinereum* [ibid., xii, p. 697], wilt (*Rhizoctonia crocorum*) [*Helicobasidium purpureum*: ibid., xv, p. 776], stem spot due to a *Phoma*, stem spot due to *Pleospora vulgatissima*, and the production of white shoots attributed to physiological disturbance.

Of these diseases the first two are locally the most important. Rust is found in every province of the Union, and is probably the most destructive of all lucerne diseases in South Africa, being especially severe in damp seasons. When extensive infection is present the crop should be mown or grazed even if not mature, and with changed weather conditions the next cutting will probably be healthy. Leaf spot is also induced by unfavourable conditions, and the same recommendation is made. Anthracnose has been reported from the Cape and the Transvaal, but is not common; affected plants should be dug out and destroyed. Downy mildew is widespread but not usually very harmful; the affected crop should be cut. Crown rot is moderately prevalent in the Transvaal, where it is suspected to cause much damage under favourable conditions; in affected areas drainage and cultural methods should be improved and precautions taken against the carrying of infection in the irrigation water to lower ground. In severe cases rotation is recommended. The remaining diseases are of minor importance.

WILLIS (L. G.) & PILAND (J. R.). **A response of Alfalfa to borax.**—*Science*, N.S., lxxxvi, 2225, pp. 179–180, 1937.

Several instances of crop responses to borax have been observed in

North Carolina soils with a high hydrogen-ion concentration and an abundance of calcium salts. Romaine [lettuce], for instance, was practically cured of symptoms that have been considered typical of manganese deficiency by the application to the soil of borax at the rate of 4 lb. per acre. Recently a problem involving lucerne production has become acute. The terminal leaves of the plants turn yellow, the apical buds do not develop normally, extensive wilting occurs in dry weather, while severe aphid and leafhopper infestation is also a feature of the trouble. The soil in which this condition was first noticed had been heavily limed. Borax (5 lb. per acre in March) effectively corrected the disorder during the same season [*R.A.M.*, xvi, p. 680], but a similar treatment applied late in May did not operate until the following year, possibly on account of photoperiodic factors. Manganese appears to supplement the effect of borax, while zinc is antagonistic and the influence of copper negligible. The disorder, which appears to be generally prevalent, corresponds in all respects to the supposedly transmissible lucerne yellows [ibid., x, p. 192].

Fischer (G. W.). **Observations on the comparative morphology and taxonomic relationships of certain grass smuts in western North America.**—*Mycologia*, xxix, 4, pp. 408–425, 18 figs., 1937.

Details are given of the author's comparative studies of the morphology of the smuts of barley grasses (*Hordeum* spp.), brome grasses (*Bromus* spp.), and wheat grasses (*Agropyron* spp.) in the American north-west, which had hitherto been ascribed to *Ustilago lorentziana*, *U. bromivora*, and *U. bullata* [*R.A.M.*, xvi, p. 517], respectively. The examination of 19 current collections and 41 herbarium specimens of the smuts showed that they are morphologically similar, variations in the size of the chlamydospores and in the nature of their epispores being wider in the various collections of *U. bromivora* than between the chlamydospores of this species and those of either of the other two species. It is therefore considered that the three smuts really belong to one composite species which should be known by the earliest name *U. bullata*. An emended description of the species is given and a list is appended of 37 grasses, comprising five species of *Agropyron*, 23 of *Bromus*, one of *Elymus*, seven of *Hordeum*, and one of *Sitanion*, which are recognized as hosts of *U. bullata*; of this total, ten species are reported for the first time.

Hopkins (J. C. F.). **A programme for the control of diseases of Apple trees in Southern Rhodesia.**—*Rhod. agric. J.*, xxxiv, 8, pp. 619–630, 1 pl., 1937.

In view of the increasing importance of deciduous fruit planting in Rhodesia the author briefly describes the symptoms, life-histories, and control of the chief diseases of apples, viz., mildew (*Podosphaera leucotricha*) (sometimes very severe on susceptible varieties at elevations up to 4,000 ft. and found even at 7,000 ft.), black rot (*Physalospora cydoniae*) [*P. obtusa*: see next abstract], bitter rot (*Glomerella cingulata*), and blister and fruit cracking (*Coniothecium chomatosporum*) [*R.A.M.*, xv, p. 586]. The last three can be controlled by improved orchard sanitation, while the schedule recommended for mildew consists in removing

and destroying or digging in all diseased material during the dormant period, applying a dormant spray of lime-sulphur 1 in 20 + miscible oil, an application of lime-sulphur 1 in 30 between open cluster and pink bud, and one of sulphur dust or lime-sulphur 1 in 100 (with colloidal sulphur, 1½ lb. per 100 galls., or wettable sulphur, 8 lb. per 100 galls. added) at petal fall, again two weeks later, and subsequently at monthly intervals if necessary. Other fungi attacking apples in Rhodesia are *Schizophyllum commune* [ibid., xvi, p. 154], *Diaporthe perniciosa* [ibid., xv, p. 555], *Valsa leucostoma* [ibid., xv, pp. 283, 447], *Corticium salmonicolor*, *Armillaria mellea*, *Leptothyrium pomi*, and *Venturia inaequalis*.

The paper concludes with notes on the selection of the right types of spray materials and equipment.

FOSTER (H. H.) **Studies of the pathogenicity of Physalospora obtusa.**—*Phytopathology*, xxvii, 8, pp. 803–823, 3 figs., 4 graphs, 1937.

Almost ideal conditions for the initiation of apple leaf infection by *Physalospora obtusa* [*R.A.M.*, xvi, pp. 21, 335] were found to be provided by a 24-hour period in a moist chamber at 20° C. Seven isolates, five of them monosporous, were used in leaf infection studies on nine varieties. Nos. 8, 8a, and 9, originating from (1) apple fruit in Maine, (2) a single spore from a culture of the foregoing, and (3) from quince in France, infected all the varieties used, 12a (single spore from apple leaf) attacked Rome Beauty, Mammoth Black Twig, and Northwestern Greening, 19a (single spore from apple fruit) was pathogenic to Rome Beauty, Fameuse, Ben Davis, and Northwestern Greening, while 15a and 18a (single spores from Kalbas pear in South Africa and apple fruit in Wisconsin, respectively), caused no macroscopic symptoms on any of the test varieties. Only 10 out of 27 isolates from different parts of the United States used in inoculation experiments on Northwestern Greening and Yellow Transparent apple foliage gave positive results; nine of these strains originated in Maine, Massachusetts, or Virginia, and only occasional sparse infection was produced by material from the upper Mississippi Valley region.

Macroscopic symptoms of infection by isolate 8a of *P. obtusa* on Northwestern Greening and Yellow Transparent became apparent on trees kept at a temperature range of 12° to 28° C., the maximum incidence occurring at 20°. An eight-hour period in the moist chamber at a temperature of 20°, following inoculation with 8a and 9b (single spore from the French quince culture) on Northwestern Greening and with the former only on Yellow Transparent, was the minimum required for the initiation of infection, and it is thought that in nature 12 to 16 hours of favourable moisture and temperature conditions result in considerable infection. The minimum incubation period of the isolates consistently inducing infection ranged from 20 to 96 hours. Lesions were more numerous and showed a stronger tendency to coalesce on young, actively growing leaves than on more mature foliage. Mature pycnospores usually developed within one to two weeks from immature pycnidia on leaves placed over moistened filter-paper in Petri dishes.

Of 22 apple varieties tested in 1934 and 1935 for their reaction to isolates 8a and 9b, none proved to be absolutely immune, but a fair

degree of resistance was shown by Virginia crab, Rome Beauty, and Mammoth Black Twig.

Evidence of stomatal penetration, chiefly on the dorsal surface, was furnished by the examination of inoculated leaf material of Yellow Transparent, Northwestern Greening, Wealthy, and other varieties decolorized and then cleared in saturated chloral hydrate solution. No definite correlation was detected, in inoculation tests on Jonathan, Northwestern Greening, and Winesap, between the amount of frog-eye leaf spotting and black rotting of the fruit induced by the different isolates of *P. obtusa*.

MEHTA (P. R.). **A fruit rot of Apples caused by a species of Rhizopus.**—*Curr. Sci.*, vi, 2, pp. 58–59, 1 fig., 1937.

Apples received from Quetta were affected by a soft rot, causing a russet- to verona-brown discoloration of the skin which easily peeled away from the underlying tissue. The fruit emitted a slightly sour odour and the zinc-orange-coloured pulp was readily detachable from the tissues of the core. No fungal growth was apparent on the surface, but the seeds bore mycelium. A *Rhizopus* of the *arrhizus* group was isolated from the affected material with sporangiophores mostly 160 to 480 μ long, globose sporangia 80 to 176 (mostly 100 to 112) μ in diameter, and slightly angular, faintly striated, sometimes hyaline spores 5 to 7·2 μ in diameter. Growth took place at 10° to 40° (optimum 37°) C., and sporangial formation at 15° to 40°. Inoculation of slightly wounded, ripe and unripe apples resulted in rotting, which was slow from 15° to 23°, but very rapid from 32° to 38°.

HILDEBRAND (E. M.) & HEINICKE (A. J.). **Incidence of fire-blight in young Apple trees in relation to orchard practices.**—*Mem. Cornell agric. Exp. Sta.* 203, 36 pp., 2 figs., 1937.

Investigations carried out at Cornell during a period of four years into the incidence of fireblight [*Erwinia amylovora*: *R.A.M.*, xvi, p. 473, and next abstracts] in an orchard of young apple trees of different varieties subjected to different soil managements and cultural practices showed that the primary conditions that must be fulfilled before an outbreak can take place are (1) temperatures favouring abundant insect activity and (2) sufficient moisture for the oozing of cankers, i.e., rainfall of over ½ in. during blossoming. The amount of annual injury was correlated to a certain extent with the amount of initial blossom infection which was common in 1932 and 1933 and relatively scarce in 1934 and 1935, the annual injury per average tree for the four years being 6·9, 9·5, 7·9, and 3·4 ft., respectively; the 7·9 ft. injury in 1934 was of less consequence to the trees than 6·9 ft. in 1932 because of the growth made in the intervening years. The least susceptible variety was Delicious, followed (in order of increasing susceptibility) by Northern Spy, McIntosh, Cortland, and Rhode Island Greening, the percentage of the trees showing over 50 ft. injury being 0·5, 3, 13, 18, and over 50, respectively. Generally speaking, shoot injury was the principal type of damage, followed by spur, branch, and body blight, but individual varieties reacted differently as regards the various types of injury. The greatest degree of susceptibility was induced by soil cultivation, lucerne

supporting a more resistant type of growth, and trees on sod being the most resistant of all. Comparing the effect of cultural methods on the tree parts affected, spur blight and shoot blight were most prevalent on trees receiving cultivation followed by those with lucerne and those on sod, whereas with both branch and body blight the sequence was cultivation, sod, and lucerne. Pruning once in three seasons affected the distribution more than the amount of injury. Spur blight was approximately half as abundant on pruned as on unpruned trees, while shoot blight was greater on pruned trees. Pruning did not appreciably affect branch blight, but the pruned trees had about nine times as much body blight as the unpruned. It reduced the total number of points of infection, but increased lineal spread. Nitrogen fertilization decreased the percentage of spurs blossoming and blighting, increased shoot blight, and decreased branch blight, but in general caused an increase in the total amount of fireblight injury. The average girth measurements for young blighted apple trees under lucerne, cultivation, and sod treatment were, respectively, 26·61, 25·6, and 24·15 cm.; if both blight and growth factors are considered, the best cultural treatment was lucerne without nitrogen. Wounds produced by ringing became infected and the operation tended to increase susceptibility the following season.

Hildebrand (E. M.). **Infectivity of the fire-blight organism.**—*Phytopathology*, xxvii, 8, pp. 850–852, 1937.

Using a modification of the micro-pipette technique for single-cell isolation devised by W. H. Wright and collaborators (*J. Lab. clin. Med.*, xii, p. 795, 1927; *J. Bact.*, xvii, p. 10, 1929), the writer transferred about 100 single cells of the fireblight organism (*Erwinia amylovora*) [see preceding and next abstracts] between 8 and 16 hours old to the stigmas, anthers, and nectaries (wounded or uninjured) of pear flowers on forced dwarf trees in the greenhouse in January and February without success. Positive results were obtained, however, in one out of two similar tests on dwarf apples when a single cell was transferred to the nectary, the closed condition of which, in contrast to the open pear nectaries [ibid., xiv, p. 370], probably prevented the desiccation liable to occur at the low relative humidities (50 per cent.) prevailing in the greenhouse at that season. In a further series of trials on excised apple flowers in moist chambers at 24° C., infection developed in 9 out of 15 single-cell inoculations into the nectaries, and positive results were also secured in 3 out of 5 cases with 2 cells, in 4 out of 5 with 5, and in all with 10 or more. Evidence was next obtained that apple nectar acts as a culture medium for single cells of *E. amylovora*, while juice extracted from pear shoots and fruits serves a similar purpose for large numbers of the organism.

These observations are considered to support the view that a single active fireblight canker may initiate a severe epidemic in an orchard, calculating that a 25-year-old tree in full bloom provides some 100,000 blossoms, for each of which potential inoculum is generated by single cells at the rate of 100,000 bacteria in 17 hours. One bee out of the many thousands in a hive may easily visit and infect the flowers on ten other trees in one of its many daily trips, so that the possibilities of

dissemination, reckoning 27 trees to the acre and presupposing the continuance of four or five days of good weather, are sufficient to cause an epiphytotic.

Hsiong (S. L.) & Hildebrand (E. M.). **Maternal inheritance in Pears.**—*Phytopathology*, xxvii, 8, pp. 861–862, 1937.

In reciprocal crosses between certain horticultural varieties of *Pyrus communis* (Phelps, Flemish Beauty, Pulteney, and Seckel) and Kieffer (presumed to be a hybrid between *P. communis* and *P. serotina*), made with a view to developing resistance to fireblight (*Erwinia amylovora*) [see preceding abstracts], an apparent inclination was noted towards a closer resemblance of the F_1 individuals to the seed than to the pollen parent. The results of inoculation tests with the organism on F_2 trees of the crosses showed in like manner the tendency towards maternal inheritance of resistance to the disease.

Weinberger (J. H.) & Cullinan (F. P.). **Symptoms of some mineral deficiencies in one-year Elberta Peach trees.**—*Proc. Amer. Soc. hort. Sci.*, xxxiv, pp. 249–254, 2 figs., 1937.

A description is given of the symptoms produced on one-year-old Elberta peach trees grown in sand cultures with a nutrient solution lacking either nitrogen, phosphorus, calcium, magnesium, iron, sulphur, manganese, or boron.

Jones (W.). **Armillaria mellea Vahl ex Fr. on Raspberries in British Columbia.**—*Sci. Agric.*, xvii, 12, pp. 752–753, 1 pl., 1937.

During surveys in 1936 numerous Cuthbert, Viking, and Lloyd George raspberry plants in eight plantations in five districts of the Lower Mainland, British Columbia, as well as several thimbleberry (*Rubus parviflora*) plants, were found to have been partially or entirely killed by *Armillaria mellea* [*R.A.M.*, xvi, p. 564]. The fungus appears to be widely distributed in the Lower Mainland, and to be very prevalent in the woods of the raspberry-growing districts; so far, however, it has not been found in the raspberry plantations of Vancouver Island. The planting of raspberries on newly cleared land known to be infected is deprecated.

Dotti (F.). **Influenza del solfato di rame nella lotta contro il Coryneum beijerinckii del Pesco.** [The influence of copper sulphate in the campaign against *Coryneum beijerinckii* on the Peach.]—*Pubbl. R. Ispett. Agric. Prov. Ravenna*, 25 pp., 1936. [Abs. in *Hort. Abstr.*, vii, 3, p. 225, 1937.]

Field experiments on Amsden, Morellone, and Triumph peaches attacked by *Coryneum beijerinckii* [*Clasterosporium carpophilum*] in Northern Italy [cf. *R.A.M.*, xiii, p. 706; xvi, p. 136] demonstrated the absolute efficacy of dormant treatments with alkaline Bordeaux mixture containing 3 per cent. copper sulphate and 3 per cent. lime. Three applications—the first at leaf fall, the second between the end of December and middle of January, and the third about 20 days before flowering—should suffice for moderately severe attacks, but in cases of intensive infection a fourth may be interposed.

Deslandes (J.). **Doenças da Bananeira.** [Diseases of the Banana.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 199–206, [1937].

The author gives a preliminary account of banana diseases observed in Brazil [*R.A.M.*, xiii, p. 250; xv, p. 818] since 1931, among which the following may be mentioned. Dwarf bananas suffer from a deformation of the crown of unknown etiology, chiefly characterized by the severe stunting of the leaves, which have a more vertical habit than normal and frequently all depart from the same level on the trunk; when not completely aborted, the bunches develop poorly and for the most part are killed by the sun. A mosaic disease causing yellow, sometimes broken streaks darkening with age on the leaves was recorded in São Vicente in 1931, but does not do any damage. About the same year 'maça' [apple] bananas and other varieties of *Musa sapientum* in the province of Piracicaba were severely attacked, and have since been practically wiped out by a disease strongly resembling the Panama disease [*Fusarium oxysporum* var. *cubense*], but the causal agent of which has not yet been determined. Leaf spots are caused by a number of various fungi, including *Haplographium atrobrunneum*, *Gloeosporium musarum*, *Helminthosporium torulosum*, and *Nigrospora* sp., and end rot of the fruit by *Stachylidium theobromae* [ibid., xvi, p. 110] and *H. torulosum*. A list is also given of the fungi causing storage and transit rots of bananas shipped from Brazil, most of which have already been recorded in this *Review*.

Tissot (P.). **La maladie de Sigatoka du Bananier.** [The Sigatoka disease of the Banana.]—*Rev. Bot. appl.*, xvii, 189, pp. 372–374, 1937.

A brief popular account is given of the symptoms, geographical distribution, and control of banana leaf spot (*Cercospora musae*) [*R.A.M.*, xvi, p. 729], not yet recorded for Africa, reference also being made to the influence of environmental factors on infection and to varietal reaction to the disease.

Reinking (O. A.). **Isolations made from heart rot of Banana in Honduras.**—*Phytopathology*, xxvii, 8, pp. 853–854, 1937.

A severe form of heart rot is stated to have been prevalent in cut-over banana plantations in Honduras in February, 1936, characterized by a brown, malodorous decay proceeding downwards from the tip of the central group of rolled young leaves, which were frequently pushed upwards in a folded mass. *Fusarium moniliforme* [*Gibberella moniliformis*: *R.A.M.*, iv, p. 569; xi, p. 353] and bacteria were isolated from some of the diseased plants [cf. ibid., v, p. 617], whereas in the Philippines the fungus associated with a similar condition of banana and abacá [*Musa textilis*] is *F. moniliforme* [*G. fujikuroi*] var. *subglutinans*, which has also been reported on bananas from Trinidad [ibid., xiii, p. 788] and Syria [ibid., xvi, p. 264]. Further studies are therefore desirable to determine the exact identity of the organism concerned in the etiology of heart rot in the various countries affected.

Rangel (J. F.). **A podridão preta do Abacaxi.** [The black rot of Pineapple.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 329–332, [1937].

In giving a summary of the results of his investigations on black rot

(*Thielaviopsis* [*Ceratostomella*] *paradoxa*) [*R.A.M.*, xv, p. 693] of pineapple, which is stated to be one of the chief causes of the serious decline of recent years in the export of this fruit from Brazil, the author says that much of the rot could be effectively and most economically prevented by carefully avoiding during harvest unnecessary wounding or bruising of the pineapples. Experiments on control of the rot in transit and storage showed that formalin fumigations were the most effective and cheapest method, and that entry of the fungus through the cut end of the scape is effectively prevented by applications to it of paraffin wax.

SHIPPY (W. B.). **Flordo spray.**—*Pr. Bull. Fla agric. Exp. Sta.* 504, 2 pp., 1937.

The Flordo spray, consisting of 10 lb. soap (granular or chip form), $2\frac{1}{2}$ lb. copper sulphate, and 1 qt. of 26 to 28 per cent. ammonia per 100 galls. of spray mixture, is stated to have proved an effective fungicide on various plants, especially ornamentals, in Florida during the last 8 years.

KLEE (F.). **Erddämpfungs-Erfahrungen.** [Soil-steaming experiences.] —*Blumen- u. PflBau ver. Gartenwelt*, xli, 35, p. 405, 1 fig., 1937.

Details are given of the construction and application of a soil-steaming apparatus [*R.A.M.*, xvi, p. 693] consisting of a low-pressure Galloway tube boiler, fitted either with three barrels or three conical frames, inverted over gridirons to hold $\frac{1}{2}$ cu. m. each of soil, the barrels being furnished with a sieve inserted a third of the way up and a set of pipes for the uniform distribution of the steam below. Potatoes at various depths in the soil served as indicators of the completion of the process, which occupied a period of 20 to 30 minutes per barrel, 16 cu. m. of soil being treated in one day.

Methoden zur Prüfung von Pflanzen- und Vorratsschutzmitteln. [Methods of testing plant and supplies protectives.]—*Mitt. biol. Anst.* (*Reichsanst.*) *Berl.*, 55, 55 pp., 53 figs., 20 diags., 2 graphs, 1937.

This valuable compilation of contributions (X to XXXIII) from specialists in various branches of phytopathology describing methods for the testing of disinfectants for the control of diseases and pests of plants and stored provisions is under the general editorship of W. Trappmann, who discusses in the opening section the principles and organization of the official trials of such preparations. A. Winkelmann deals with the testing of cereal seed-grain disinfectants against wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*], snow mould of rye (*Fusarium*) [*Calonectria graminicola*], stripe disease of barley (*Helminthosporium gramineum*), and loose smut of oats (*Ustilago avenae*); with the general principles of fungicide testing, as exemplified by the treatment of rose mildew [*Sphaerotheca pannosa*], *Fusicladium* [*Venturia*] of fruit trees, hop *Peronospora* [*Pseudoperonospora humuli*] (also described in detail by H. Hampp and J. Jehl [*R.A.M.*, xvi, p. 836]), and club root of cabbage (*Plasmodiophora brassicae*), which is also fully discussed by H. Bremer, B. Wehnelt, and E. Brandenburg; and with

the control of vineyard diseases and pests, including *Peronospora* [*Plasmopara viticola*], *Oidium* [*Uncinula necator*], and 'roter brenner' [*Pseudopeziza tracheiphila*]. H. Zillig and L. Niemeyer describe the conditions for outdoor trials of preparations for the control of *Plasmopara viticola*, while W. Staudermann supplies a comprehensive account of greenhouse methods of testing for the same purpose. The preservation of potatoes against the storage rots due to *Phytophthora* [*infestans*] and bacteria is dealt with by O. Schlumberger. J. Liese outlines the toximetric method of testing timber preservatives by means of wood blocks [ibid., xvi, p. 581].

MONTEMARTINI (L.). **La terapia interna delle piante.** [The internal therapy of plants.]—*Riv. Biol.*, xxii, 2, pp. 311–320, 1937.

This is a concise summary of recent work [most of which has been noticed in this *Review*] on the control of certain plant diseases by the introduction of the essential nutrients into the system by appropriate manurial treatment or injections.

GONÇALVES (C. R.). **Considerações sobre a transmissão de doenças das plantas pelos insectos.** [Considerations on the transmission of plant diseases by insects.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 121–129, 1 pl., [1937].

This is a discussion, chiefly from the relevant literature, of the part played by various insects, in the transmission of fungal, bacterial, and virus diseases of plants in the field, together with a brief discussion of the different means by which they effect this transmission.

WYCKOFF (R. W. G.). **Die Isolierung hochmolekularer Eiweissstoffe mit der Ultrazentrifuge.** [The isolation of high-molecular proteins with the ultracentrifuge.]—*Naturwissenschaften*, xxv, 30, pp. 481–483, 1937.

The writer concisely reviews his recent researches (carried out in part with W. M. Stanley and other collaborators) on the crystallization of the tobacco mosaic virus by differential ultracentrifugation, and the possible extension of this method of isolation to animal viruses, such as infectious papilloma of the rabbit, composed of particles of the same order of magnitude [*R.A.M.*, xvi, p. 778].

SMITH (K. M.). **A textbook of plant virus diseases.**—x + 615 pp., 2 pl. (1 col.), 99 figs., London, J. & A. Churchill, Ltd., 1937. Price £1 1*s*.

In this valuable contribution to the diagnosis and study of plant viruses [cf. *R.A.M.*, xv, p. 107], partially based on the unpublished data of various experts in different branches of the subject, the author has adopted a modification of the classification scheme suggested by J. Johnson [ibid., xvi, p. 828], using the generic Latin name of the host instead of its popular English equivalent, partly to avoid confusion and partly on account of the wider international application of the former. The author's conception of the identification and numbering of the viruses does not coincide with that of Johnson, whose designations are included (when known) in the list of synonyms. The system followed,

then, consists in a grouping together of all those viruses chiefly associated with a particular host plant, consecutively numbered 1, 2, 3, and so forth, e.g., *Beta* virus 1 (sugar beet curly top), *Beta* virus 4 (virus yellows), *Prunus* virus 3 (phony peach), *Solanum* virus 1 (potato virus X), *Solanum* virus 14 (potato phloem necrosis), *Nicotiana* virus 11 (tobacco necrosis), and *Lycopersicum* virus 3 (tomato spotted wilt). The subject is treated uniformly throughout the work, the virus being first dealt with, its properties, mode of transmission, and other characters given, and the diseases it induces described under the various hosts arranged according to plant families. The viruses as a whole are placed in the order of their plant hosts, following Hutchinson's system of classification. A separate section of the book is devoted to a detailed account of the insect vectors of plant viruses. Each chapter is supplemented by a bibliography of the literature cited, and an appendix, likely to be of great service to the practical workers, is provided in the shape of a table showing typical symptoms caused by the different viruses on their more important hosts. It is hoped that the book may both contribute to a clearer understanding of virus problems and help to elevate the study of virus diseases to its rightful position as a distinct science.

Mitchell (H. L.), Finn (R. F.), & Rosendahl (R. O.). **The relation between mycorrhizae and the growth and nutrient absorption of coniferous seedlings in nursery beds.**—*Black Rock For. Pap. (N.Y.)*, i, 10, pp. 58–73, 2 pl., 2 graphs, 1937.

White pine (*Pinus strobus*) and red spruce (*Picea rubra*) seedlings were grown for two seasons in a very infertile sand-sawdust-clay mixture, and some of the beds were given nitrogen, phosphorus, and potassium in different amounts and combinations, all the fertilized beds being inoculated in the first season with small amounts of soil containing mycorrhizal fungi [*R.A.M.*, xv, p. 596; xvi, p. 827]. Inspection of the seedlings from beds in which nutrient environment was the only variable showed that mycorrhiza were few or absent on the seedlings in all the beds given enough fertilizer to preclude any possibility of mineral nutrient deficiency, that they were more common in the beds of intermediate fertility than in the preceding, and that the best-developed mycorrhiza were formed in abundance on the seedlings grown in every soil deficient in at least one nutrient element. These results indicate that when the appropriate fungi are present and under favourable environmental conditions the frequency of incidence of ectotrophic mycorrhiza and the degree of their development on the roots of pine and spruce seedlings vary inversely as the concentration of readily available nutrients in the soil.

It was also found that the mycorrhizal seedlings of spruce and pine absorbed significantly greater amounts of nitrogen, phosphorus, and potassium and showed a significantly greater increase in dry weight than non-mycorrhizal seedlings grown under otherwise identical conditions in the unfertilized control beds, the latter seedlings showing obvious starvation, making little or no growth, and in the case of spruce, failing to survive the second growing season.

These results are considered to afford incontrovertible proof that

the addition of mycorrhizal fungi to certain soils lacking these organisms can effect the recovery of trees growing in such soils. Chemical analyses of the infected and uninfected soil failed to demonstrate sufficient differences in ammonia and readily available phosphorus and potassium to account for the seedling behaviour solely on the basis of the activity in the soil of mycorrhizal or other fungi in the non-symbiotic role attributed to them by Burges [ibid., xv, p. 673].

Harley (J. L.). **Ecological observations on the mycorrhiza of Beech (preliminary note).**—*J. Ecol.*, xxv, 2, pp. 421–423, 1937.

In this preliminary account of a study of beech mycorrhiza in the Chiltern Hills made with special reference to ecological factors the author states that the form of the root system of adult trees was found to vary with soil depth and the extent of the incorporation of plant debris with the mineral fraction. The time of most rapid root growth (chiefly in spring and autumn) is marked by the appearance of numerous uninfected roots. This period is followed by one of infection of the new roots. The shallowest chalk escarpment soils are characterized by a short spring period of growth and infection. In the deepest escarpment soils the spring period of growth persists longer, root growth and infection going on together and being interrupted only by drought; infection is never complete, and many uninfected roots are present in spring and summer. In the very acid plateau soils the roots are near the surface and growth occurs in an upward direction in spring, the incompletely decayed litter of the previous autumn being colonized by uninfected roots; in April and May infection takes place rapidly, while in early summer it is nearly complete.

Eight conditions of infection were observed, viz., (1) uninfected roots, most frequent in the more nutritive and less acid soils, (2) roots infected at the apex only, commonly found in deep escarpment soils, (3) the loose weft type of ectotrophic infection, found only in the most nutritive soils, (4) the diffuse ectotrophic type, most common in the subneutral plateau soils, (5) the pyramidal ectotrophic type, a deeper brown than the preceding, with a racemose habit, confined to the acid plateau soils or places with an accumulation of leaf litter and raw humus, (6) the nodular type consisting of many small racemose systems held together and overgrown by a common sheath, occurring only in acid soils, especially when waterlogged, (7) the endotrophic coralloid type common only in raw-humus soils, and (8) secondary infections by new fungi parasitic on the hyphal sheath and the root tissues within and often recognizable by their characteristic colour (e.g., pink, mauve, bronze, or black); these are commonest in acid soils. The very acid soils contain roots characterized by virulent fungal symbionts, while more nutritive soils contain types of infection in which the growing point of the root is not always inhibited by the fungal sheath. The poorest growth of beech on soils with poor humus incorporation therefore appears to be correlated with the most abundant infection, while the lack of successful growth on the shallow escarpment soils appears to be correlated with the small volume of relatively nutritive soil and its incapacity to retain sufficient water. The moderately acid, deep, nutritive, water-retaining soils bear trees of the greatest vigour. In

these soils the roots are only partially infected and the fungus does not completely control their form.

With rare exceptions all types of infected roots contained more nitrogen per unit weight than uninfected roots. Root systems in poor soils contained more nitrogen than those in better soils. Higher nitrogen content was not correlated with a greater supply of nitrogen to the tree as a whole, there being an inverse correlation between root infection and the nitrogen content of the leaves and buds. It is concluded that while mycorrhizal infection is beneficial to beech trees on poor soil in that it supplies nitrogen, yet, as regards the nitrogen supply to the tree as a whole, it does not completely make up for a low nitrogen content in the soil [see preceding abstract]. The variation in size and vigour noted in the trees studied is attributable to soil variations rather than variations in the mycorrhizal root infections. If such infection does stimulate tree growth this effect must be subsidiary to the effects of soil variations or associated with them in some way not as yet understood.

BALDACCI (E.). **Osservazioni e ricerche sulla vaccinazione delle piante di Fagiolo con il fungo del 'mal della tela'.** [Observations and researches on the vaccination of Bean plants with the 'toile' disease fungus.]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, x, 12 pp., 1937. [Latin and English summaries.]

Continuing his studies on acquired immunity [*R.A.M.*, xv, p. 389; xvi, p. 481] the author repeated the experiments of Carbone and his fellow workers on the immunization of bean (*Phaseolus vulgaris*) seedlings against 'toile' disease (*Botrytis cinerea*) under the same experimental conditions as these workers and using a transfer of the 'toile' organism obtained from Carbone. The fungus in question, which Beauverie agreed was the same as that used by him in his researches on immunization (*C.R. Acad. Sci., Paris*, cxxxiii, pp. 107–110, 1901), was identified as a *Rhizoctonia*, a diagnosis confirmed by Peyronel, Castellani, and Ciferri, the last-named stating that it was identical with the 'Vermehrungspilz' (*Moniliopsis aderholdi*) [ibid., xv, p. 586]. Inoculations of the control plants showed that the fungus was only weakly pathogenic, and attempts at 'vaccination' by the method of Carbone and Kalajev [ibid., xi, p. 798] gave negative results, the 'vaccinated' plants showing no increase in resistance over the controls. The fungus was not pathogenic to potato.

GÄUMANN (E.). **Immunitätsprobleme bei Pflanzen.** [Immunity problems in plants.]—*Schweiz. med. Wschr.*, lxvii, 1, pp. 10–15, 4 graphs, 1937.

Some concrete examples are cited to illustrate various aspects of the immunity problem in plants [*R.A.M.*, xvi, p. 50 *et passim*], which is critically discussed in the light of contemporary researches under the headings of infection and disease contraction, protection against infection, passive and active defence against disease, fluctuations in the individual range of disease resistance, the inheritance of disease resistance, and arbitrary intervention in the course of the disease (therapy).

CHOWDHURY (S.). **Germination of fungal spores in relation to atmospheric humidity.**—*Indian J. agric. Sci.*, vii, 4, pp. 653–657, 1937.

Half-inch squares of thin sheet viscose soaked in 1 per cent. glucose solution and dried were used, as recommended by Galloway [*R.A.M.*, xiv, p. 585], as the substratum for the spores of eight Indian fungi, in tests of their germinability in relation to varying percentages of atmospheric humidity from 84·9 to 100. The sheets were suspended in stoppered bottles of 500 c.c. capacity containing 30 c.c. of a sodium chloride or sulphuric acid solution of definite specific gravity at 25° C. Only three species germinated after 20 hours at 90 per cent. relative humidity, viz., *Acrothecium* [*Curvularia*] *penniseti* [ibid., xiii, p. 475], *Alternaria brassicae* (Berk.) Bolle [ibid., xvi, p. 83], and *Cladosporium herbarum*; the minimum requirement of *Helminthosporium frumentacei* Mitra was 91 per cent., of *Gloeosporium tabernaemontanae* and *Phyllosticta cajani* 93·9 per cent., and of *Colletotrichum falcatum* [ibid., xv, p. 463, and below, p. 67] and *C. lindemuthianum* 95 per cent.

MURPHY (P. A.) & LOUGHNANE (J. B.). **A ten years' experiment on the spread of leaf roll in the field.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxi, 48–53, pp. 567–579, 2 figs., 1 graph, 1937.

Details are given of a field experiment carried out in eastern Ireland to ascertain the maximum and minimum spread of potato leaf roll [*R.A.M.*, ix, p. 197] during a ten-year period. It was found that on this basis the years fell into three broad groups, the amount of infection appearing within a $10\frac{1}{2}$ ft. radius of the source not exceeding 75 per cent. in 1926, 1927, and 1929, 50 per cent. in 1930, 1932, 1933, and 1934, and 15 per cent. in 1928, 1931, and 1935. Minimum spread extended to the third plant along the drill and across 1 to 3 drills, and maximum spread exceeded the fourteenth plant and the fifth drill. The evidence showed that in an average year no plant separated from the source of infection by less than 80 in. along and 50 in. across the drills is likely to escape infection, and none separated from the source of infection by more than 21 ft. along and $10\frac{1}{2}$ ft. across the drill is likely to take it. Probably because the prevailing winds are southwesterly the disease spread principally to the north and east.

Most of the infection apparently occurred during a six weeks' period between the end of May and early July. The resulting primary leaf roll appeared during the nine weeks that elapsed from the end of June to the end of August, the incubation period being 37 days at first and 40 to 60 days later. In late seasons most of the infection occurred during July or after. The years of least spread had unusually wet weather in June; this limited aphid increase during the critical period. Maximum infection was induced by normal rainfall and temperature in June, which favoured rapid plant growth while at the same time increasing the aphid population. The years of moderate infection were marked by a dry, hot June, which ripened the plant prematurely. The aphids hibernated each year in an active condition on cabbages in the vicinity. The general absence of leaf roll from eastern Ireland is probably due to the scarceness of the winter hosts of *Myzus persicae* near the potato fields.

PUTTEMANS (A.). **Relação dos fungos e bacterias encontrados na Batateira (Solanum tuberosum L.).** [List of the fungi and bacteria recorded on the Potato (*Solanum tuberosum* L.).]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 265–302, [1937].

The author gives as full a list as possible of all the fungi and bacteria, both parasitic and saprophytic, that have been recorded up to date on the potato throughout the world. The organisms are listed in alphabetical order, with full synonymy and citations of the original descriptions, and where possible, the common Portuguese, Spanish, French, Italian, English, and German names of the diseases caused by the pathogens. In a second list the organisms are grouped in their taxonomic order, following Clements and Shear's system.

COSTA (A. S.) & KRUG (H. P.). **Molestias da Batatinha em São Paulo.** [Potato diseases in São Paulo.]—*Bol. Inst. agron. Campinas* 14, 55 pp., 3 col. pl., 47 figs., 1937.

This is a semi-popular account of the chief diseases of the potato in the State of São Paulo, Brazil. Very frequently in storage and more rarely in the field the tubers are attacked by various rots, three types of which are briefly described, namely, a dry rot caused by various *Fusarium* spp., a stem-end rot caused by different organisms [not specified], and a wet rot, chiefly due to bacteria. The other parasitic diseases discussed include common scab (*Actinomyces*) [*scabies*], *Rhizoctonia* [*Corticium*] *solani*, silver scurf (*Spondylocladium atrovirens*) [*R.A.M.*, xiv, p. 223], early blight (*Alternaria solani*), late blight (*Phytophthora infestans*), wilts caused by *Fusarium oxysporum*, *Verticillium albo-atrum*, *Sclerotium rolfsii*, *Pseudomonas* [*Bacterium*] *solanacearum*, and black leg (*Bacillus phytophthorus*) [*Erwinia phytophthora*]. The virus diseases recorded so far include mild mosaic, super-mild mosaic, crinkle mosaic, rugose mosaic, aucuba mosaic, streak, leaf roll, spindle tuber, and calico. The importation of seed-tubers from the Argentine, the chief source hitherto of the new planting material in Brazil, is strongly deprecated, since recent inspections have shown that this seed usually contains as much as 50 per cent. infection with various virus diseases. Of the certificated European varieties, the Dutch Eigenheimer and Bintje, and the German Rotweissragis and Allerfrühste gelbe are recommended as the most likely to give good results in Brazil. The paper terminates with a discussion of the more important physiological troubles of the potato, and of methods for the control of the parasitic diseases of the crop.

ORTH (H.). **Der Einfluss der Luftfeuchtigkeit auf das Keimverhalten der Sporangien von Phytophthora infestans (Mont.) de Bary, des Erregers der Kartoffelfäule.** [The influence of atmospheric humidity on the germination relations of the sporangia of *Phytophthora infestans* (Mont.) de Bary, the agent of Potato blight.]—*Z. Pfl-Krankh.*, xlvii, 8, pp. 425–447, 7 graphs, 1937.

The results [which are fully discussed and tabulated] of experiments to determine the influence of relative atmospheric humidity (as estimated by the method of von Janisch based on the fact that solutions of salts have definite vapour pressures) on sporangial germination in

Phytophthora infestans [*R.A.M.*, xvi, p. 707] showed that even a slight reduction (about 5 per cent.) below 100 per cent. caused a decline in the capacity of the sporangia for zoospore formation, while exposure to 76 per cent. relative atmospheric humidity completely destroys the sporangia within an hour. Germination was also considerably impaired, especially at the moderate optimum temperatures for the development of the fungus, by one hour's exposure to relative humidities of 94 or 86 per cent. Fluctuations of 5 per cent. or so in the relative atmospheric humidity, even of brief duration, were found to be more detrimental to sporangial development than changes of temperature within a fairly wide range (2° to 34° C.).

RAINIO (A. J.). **Perunarton aiheuttamat tuhot Suomessa ja sen esiintymiseen vaikuttavista tekijöistä.** [The damage caused in Finland by Potato blight and the factors influencing its occurrence.]—*Valt. Maatalousk. Julk.*, 95, 47 pp., 3 graphs, 7 maps, 1937. [German summary.]

The annual incidence and virulence of potato blight (*Phytophthora infestans*) [see preceding and next abstracts] in Finland are largely dependent on the weather conditions prevailing in August and September. During the period 1925–36 there were six normal (1927, 1928, 1930, 1931, 1932, and 1936), two severe (1925 and 1934), and four mild years (1926, 1929, 1933, and 1935). The severe blight seasons were characterized by exceptionally damp, close weather, while in the mild ones the critical periods for infection [*R.A.M.*, xvi, p. 514] were fairly dry, with relatively low temperatures and some sharp frosts in the north and east of the country. In the severe year 1934 the reduction in the Finnish potato yield amounted to 4,249,416 quintals, representing a sum of M. 246,000,000 [193·23 M. to the £ at par], the corresponding figures for the normal season 1930 being 2,893,297 quintals (M. 129,000,000), and for the mild one of 1935 1,559,681 quintals (M. 87,000,000).

The heavy losses sustained by the Finnish potato industry through blight are largely due to the widespread cultivation (55 per cent.) of the susceptible indigenous varieties, the yield of which in 1931 was reduced through premature wilting of the foliage by 25 per cent., and through tuber decay by a further 14 per cent., the corresponding figures for selected material being 7 and 3 per cent., respectively. The highest degree of resistance to tuber rot in field tests from 1931–3 was manifested in the early group by Pole Star (average 2·7 per cent. infection), in the medium-early by Rosafolia and Direktor Johanssen (0 and 1·2 per cent., respectively), in the medium-late by Immergut, Parnassia, Erdgold, and Eldorado (0·2, 0·3, 0·4 and 0·5 per cent., respectively), and in the late by Glasgow Favourite (7·7 per cent.). Resistance to leaf infection was most pronounced in the early group in Rosafolia and Lichtblick, in the medium-early in King George V and Paul Wagner, in the medium-late in Jubel, Parnassia, and Max Delbrück, and in the late in Ceres.

It was experimentally shown that infection of the aerial portions of potato plants takes place in Finland a fortnight before any external symptoms become visible on the foliage. The difficulties of growers in

timing the application of sprays have been largely overcome by the provision of adequate observers and by the preparation of special isophane maps indicating the well-defined relationships existing between climatic factors and the development of blight on a given variety at a certain time in different parts of the country. Every year the disease originates in the coastal districts bordering the Gulf of Bothnia, on the isthmus of Karelia, near Viipuri, in the Kymijoki valley, and round the lakes of central Finland, whence it radiates to other localities, reaching Uusimaa last. The northern limits of the fungus are determined exclusively by the degree of frost in a given season; in favourable years it may be found in the northern Arctic coastal regions, having reached Petsamo (69° 32′ northern latitude, 27° 52′ eastern longitude) in 1935. Atmospheric humidity appears to play the major part in the regular development of potato blight, which is almost invariably most prevalent in low-lying situations, near water, and tends to commence in localities where damp lake winds predominate or converge [cf. ibid., xvi, p. 831].

Mundkur (B. B.), Pal (B. P.), & Nath (P.). **Relative susceptibility of some wild and cultivated Potato varieties to an epidemic of late-blight at Simla in 1936.**—*Indian J. agric. Sci.*, vii, 4, pp. 627–632, 1 pl., 1937.

Late blight of potatoes (*Phytophthora infestans*) [see preceding abstracts] developed in a virulent form at Simla in 1936, favoured by wet and cloudy weather, especially during July and August [*R.A.M.*, v, pp. 213, 595; x, p. 224]. Of the many European, South American, and Indian potato varieties growing at the local Sub-Station some showed a certain degree of resistance to the disease, from which, moreover, a high proportion of the foreign tuber-forming *Solanum* spp. under observation were semi- or wholly immune. The epidemic thus afforded an opportunity of ascertaining the reaction of these varieties and species to the local physiologic race of *P. infestans* under ideal conditions for the fungus.

President was the most resistant of the commercial varieties under cultivation, while Pusa White, Gharwal, Khabrar, Conoor White, and Darjeeling Red also showed some slight resistance. Only about six of the 124 South American varieties of *S. tuberosum* included in the trials showed a promising degree of resistance. Most of the varieties comprised within the species *S. andigenum* [ibid., xvi, p. 554] were highly resistant as regards stems and tubers, but the foliage contracted moderate infection in the later stages of growth. Absolute immunity was manifested by *S. demissum*, *S. neoantipoviczii* and its var. *reddickii*, and *S. antipoviczii*. Fair resistance was shown by the stems and tubers of *S. chacolense*, *S. caldsii glabrescens*, and *S. commersonii*, but the foliage of these varieties was very susceptible, as also were all parts of *S. fendleri*, *S. maglia*, *S. otites*, and *S. leptostigma*.

Muller (H. R. A.). **De Aardappelsituatie op Java als gevolg van het optreden van eenige nieuwe ziekten.** [The Potato situation in Java in consequence of the occurrence of some new diseases.]—*Landbouw*, xiii, 6, pp. 285–313, 2 figs., 1937. [English summary.]

Hitherto the most important potato disease in Java was caused by *Bacterium solanacearum* [*R.A.M.*, xiii, p. 687], but in 1936 a devastating

outbreak of late blight (*Phytophthora infestans*) rapidly decimated the crop, while many consignments of seed potatoes from Holland had to be destroyed by the plant quarantine authorities on account of infection by *Colletotrichum atramentarium* [ibid., xvi, p. 655], not previously known in the Dutch East Indies.

The physiologic race of *P. infestans* occurring in Java would appear, from the outcome of reaction tests on a number of Dutch varieties, to be identical with that found in Holland [ibid., xv, p. 246]. In these experiments West Brabanter and Iris were susceptible, Record, Bevelander, Industrie, and Nationaal fairly resistant, and Populair and Robijn highly so. Observations in various districts further indicated that Van der Veen, Eersteling [Duke of York], Bintje, Kentang Djawa, Preanger Muis, and Koninjkes belong to the highly susceptible category, while Paul Krüger [President] and Eigenheimer are less severely affected and can probably be maintained in fair condition by spraying with Bordeaux mixture. These data apply exclusively to foliage infection, tuber rot being apparently of no importance in Java where sandy soils, unfavourable to this phase of the disease [ibid., iv, p. 763], predominate in the potato-growing districts. One fungicidal treatment or two at the most should suffice for Bevelander and varieties of a like degree of resistance; in the case of Eigenheimers planted after the west monsoon an increased yield of 28 quintals per hect. may be reckoned to result from two applications of Bordeaux mixture at a cost of roughly Fl. 40. In connexion with the extended cultivation of *Phytophthora*-resistant varieties, it is pointed out that a number of these, e.g., Bevelander, Eigenheimer, Robijn, and Populair are highly susceptible to *Bact. solanacearum*, and can therefore be grown only in districts where slime disease is relatively unimportant. Progress has been made, however, in the development of resistance to *Bact. solanacearum* by the hybridization of certain commercial varieties with the South American *Solanum andigenum* and *S. antipoviczii*, which are likewise resistant to *P. infestans* [see preceding abstract]. The importation of seed potatoes from Holland being temporarily impracticable owing to infestation by *C. atramentarium*, attempts are in progress to combat this fungus by various methods.

A useful tabular synopsis is appended showing the symptoms of *Alternaria solani* [ibid., v, p. 652; xvi, p. 402], *P. infestans*, *Cercospora concors* [ibid., xv, p. 246] (which sometimes causes a certain amount of damage in the Dutch E. Indies), *Bact. solanacearum*, and *Colletotrichum atramentarium* on potato foliage, and those of *A. solani* (not yet recorded on tubers from the Dutch East Indies), *P. infestans*, *C. atramentarium*, and *Bact. solanacearum* on the tubers.

[This paper also appears as *Korte Meded. Inst. PlZiekt.* 23, 29 pp., 2 figs., 1937.]

PUTTEMANS (A.). **Reivindicação visando a denominação scientifica da doença da Batateira (Phytophthora infestans) (Mont.) de By.** [A plea for the revision of the scientific name of Potato blight (*Phytophthora infestans*) (Mont.) de By.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 341–350, [1937].

named *Botrytis devastatrix* by Mlle Libert in the *Journal de Liège*, on the 19th August, 1845, i.e., eleven days before Montagne presented his paper to the Société Phylomatique of Paris, in which he described the same fungus under the name *B. infestans*. On grounds of priority, therefore, the author renames the fungus *P. devastatrix* (Lib.) n.comb.

FISH (S.), PUGSLEY (A. T.), & RYLAND (J .P.). **'Leak' or 'watery wound rot' of Potatoes.**—*J. Dep. Agric. Vict.*, xxxv, 6, pp. 287–289, 2 figs., 1937.

Potato growers in the vicinity of Dalmore and Koo-wee-rup, Victoria, have for some years suffered severe losses in marketing as a result of tuber infection by *Pythium de Baryanum* following mechanical injury [*R.A.M.*, x, p. 544]. The disease is most prevalent in hot weather and in potatoes from farms where rotation is not practised, little trouble being experienced by farmers adopting a long rotation. The fungus may produce complete decay of the tuber in a day or two. Control recommendations include long rotation, destruction of diseased tubers, avoidance of mechanical injury, bagging sound potatoes only, keeping the temperature of the tubers as low as possible by digging only in the cool hours, or digging 'short' runs before bagging, and not using loading hooks for potatoes from affected localities.

BALDACCI (E.). **Ricerche ed esperienze sulle malattie del Riso (Oryza sativa L.). II. Il 'brusone' non parassitario del Riso.** [Researches and experiments on diseases of Rice (*Oryza sativa* L.). II. Non-parasitic blast of Rice.]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, x, 30 pp., 21 figs., 1937. [Latin and English summaries.]

In 1934, rice growing on freshly reclaimed peat soil in a permanently or semi-permanently flooded region in the vicinity of Ferrara was affected by a non-parasitic form of blast causing a loss of yield ranging from 20 to 100 per cent. All the affected plants showed abnormalities in the roots before the aerial parts developed any symptoms. The extremities of the fine rootlets were discoloured and wilted and later sometimes showed the presence of saprophytes. In two instances only did the affected plants show the presence of *Piricularia oryzae*. Drainage water from the soils in question proved toxic to rice seedlings, impeding germination, and causing injuries to the fine rootlets, identical with those observed in nature. It is concluded that the disease is probably due to a number of soil factors which have not yet been definitely ascertained, and principally to insufficient aeration aggravated by anaerobiotic or microanaerobiotic conditions in the soil.

NAITO (N.). **On the effect of sunlight upon the development of the Helminthosporium disease of Rice.**—*Ann. phytopath. Soc. Japan*, vii, 1, pp. 1–13, 1 graph., 1937. [Japanese, with English summary.]

Rice seedlings were experimentally shown to be more extensively infected by *Ophiobolus miyabeanus* [*R.A.M.*, xvi, p. 771] in the absence than in the presence of light. Absence of light further increased both the incidence of conidial germination and the length of the germ-tubes. Using four glass boxes kept under identical conditions except for variations in light intensity, the writer determined the effect on the course

of the disease of shading the seedlings after inoculation. The maximum number of fungal lesions per unit length of leaf occurred on the seedlings grown in the box covered with two sheets of cotton cloth, and the minimum on those in the box covered with black paper; the seedlings in the uncovered boxes and in those protected by a single sheet of cotton cloth developed an intermediate number of lesions. In a similar test to ascertain the effect of shading before inoculation, the maximum number of lesions occurred on the seedlings kept in the box covered with a single sheet and the minimum on those in the box covered with two sheets of cotton cloth, the figures for the black paper-covered and unprotected boxes being intermediate.

BEELEY (F.) & NAPPER (R. P. N.). **Annual Report. Pathological Division.**—*Rep. Rubb. Res. Inst. Malaya, 1936*, pp. 77–98, 1937.

As a result of tests conducted since 1933, an improved method of trenching for the control of root disease of *Hevea* rubber (*Fomes lignosus*, *F. noxius*, and *Ganoderma pseudoferreum*) [*R.A.M.*, xvi, pp. 60, 798] in mature areas has been devised in Malaya. To ensure that a trench shall pass outside a diseased patch it is only necessary to examine the root sections removed as the trench progresses, and move the trench farther out if any infected material is found. The trenches should be refilled with the original soil to a depth of not less than 18 in. as soon as dug, efficiency being restored by re-digging every 18 months or two years. In six months the trenches become full of small roots, through which, however, infection passes only very slowly.

In stands 25 to 35 years of age disease patches usually occupy 25 per cent. of the planted area, but only 30 per cent. of the infected ground requires deep digging. The cost of deep marginal, and shallow central, digging of diseased patches for eradication works out locally at $80 and $30 per acre, respectively, equivalent to about $11 per acre for the whole plantation; the digging of isolation trenches costs $3 to 5 per acre in the first year, and $1 to 2 per acre for upkeep every second year, and, in addition, the full cost of digging has still to be incurred when the isolated areas are replanted or supplied. Immediate eradication is, therefore, ultimately the cheaper method. In replanting the digging of diseased patches should be completed before felling is begun, while the diseased patches are clearly marked by gaps. Whatever the method of clearing, root-disease losses must be expected in the young stand for the first few years, but if digging is adequately effected they are few and easily dealt with by means of the standard treatment, and complete, permanent eradication may confidently be expected by the time the replanted stand reaches maturity. This, however, does not apply to coastal and peat soils, in which heavy losses are experienced in undug areas apparently unaffected at felling, dormant sources of infection being roused into activity by the lowering of the water-table. In these areas, digging over the whole plantation may in the long run prove more economical than the standard treatment.

Mouldy rot (*Ceratostomella fimbriata*) [ibid., xvi, p. 772] was checked by hot, dry weather from June to August, inclusive, during which period the perithecia were seen on several occasions.

heveae: ibid., xiii, p. 125; cf. ibid., xvi, p. 798] caused more bark damage than before in a locality where clean weeding had been abandoned in favour of a heavy cover crop of *Centrosema pubescens*, which increased atmospheric humidity round the tapping panels.

The new leaf remained practically free from attack by *Oidium heveae* [ibid., xvi, p. 772] up to 10th March, after which date the later wintering trees showed mild infection. 'Cirrus' sulphur dust was found to be satisfactory even after long storage under Malayan conditions. A few cases of leaf disease (*Phytophthora* sp.) occurred in northern areas, and a sulphur-copper oxychloride dust is being prepared which, it is hoped, will control both types of mildew.

Much trouble was caused in nurseries and to young rubber in the field by the leaf spot fungi *Helminthosporium heveae* [ibid., xii, p. 425], *Gloeosporium heveae* [ibid., iii, p. 478], *Colletotrichum* sp., and *Scolecotrichum* sp.

Of eight proprietary fungicides tested against mouldy rot only 'durycolium' and 'white septol' were satisfactory and are to be added to the 'white list'.

DENNIS (R. W. G.). **Boron and plant life: recent developments in agriculture and horticulture.**—*Fertil. Feed St. J.*, xxii, 18, pp. 479–480, 482–483; 19, pp. 507, 509–511; 20, pp. 535–536, 538; 21, pp. 573–576, 4 figs., 1937.

This is a summary of recent outstanding researches on the influence of boron on plant growth and health [*R.A.M.*, xvi, p. 827], supplemented by a bibliography of 71 titles, reference to most of which has been made from time to time in this *Review*.

DENNIS (R. W. G.) & O'BRIEN (D. G.). **Boron in agriculture.**—*Res. Bull. W. Scot. agric. Coll.* 5, 98 pp., 12 pl., 2 maps, 1937.

This bulletin, the purpose of which is to indicate the present state of knowledge of the agricultural status of boron [see preceding abstract], consists of a collection of papers on the effects of boron and boron deficiency on agricultural crops arranged under the different plants, preceded by a paper of a general nature on boron in the soil and concluding with papers on the boron requirements of various crops, the function of boron in the plant, and the method of applying boron to crops. Each paper is a summary of the more important work published on the subject dealt with, and is followed by a bibliography.

COOKSON (ISABEL). **On Saprolegnia terrestris sp. nov., with some preliminary observations on Victorian soil Saprolegniales.**—*Proc. roy. Soc. Vict.*, N.S., xlix, 2, pp. 235–244, 1 pl., 2 figs., 1937.

Notes are given on 11 members of the Saprolegniales isolated from three distinct types of soil in Victoria, together with a full description (accompanied by a diagnosis in English) of a hitherto unrecorded species found in soil taken from the fern gullies of the Dandenong Ranges, near Melbourne, which is named *Saprolegnia terrestris* n.sp.

Niethammer (Anneliese). **Die mikroskopischen Boden-Pilze.** [The microscopic soil fungi.]—vi + 193 pp., 5 pl., 57 figs., 1 map, The Hague, W. Junk, 1937. Price Fl. 17.

After a brief introduction, the author devotes 100 pages to a systematic account of the fungi recorded from soil [*R.A.M.*, xvi, p. 557], with notes on distribution and characters of each species. The distribution of soil fungi by countries is discussed in considerable detail (42 pp.), and the remaining pages deal with the relations of soil fungi to pathology, to growth, to manurial questions, their activities in the soil, and their dissemination. A bibliography of 146 titles [but nevertheless somewhat incomplete] is appended.

Linke (W.). **Hop Peronospora.**—*Petit J. Brass.*, xlv, pp. 539–531 [? 541], 1937. [French. Abs. in *J. Inst. Brew.*, N.S., xxxiv, 8, p. 344, 1937.]

In these notes on the development and control of *Peronospora* [*Pseudoperonospora humuli*] on hops [*R.A.M.*, xv, p. 74; xvi, p. 61] in Belgium it is stated that Hallertau Mittelfrüh and American Cluster hops are very susceptible to the fungus at all stages of growth, Groene Bel and Buvrinnes are particularly vulnerable in flower and burr, Tettnang and Fuggles moderately resistant, and Loeres semi-immune.

Watson (Marion A.). **Field experiments on the control of Aphis-transmitted virus diseases of Hyoscyamus niger.**—*Ann. appl. Biol.*, xxiv, 3, pp. 557–573, 2 diags., 1937.

Details are given of spraying experiments in 1934 and 1935 on *Hyoscyamus niger*, grown as a biennial pharmaceutical crop, the results of which showed that infestation of the plants in the first year of growth with the aphid *Myzus persicae*, vector of the Hy. II and Hy. III viruses [*R.A.M.*, xii, p. 243], was reduced by applications of a solution of nicotine and soft soap for the first two months of vegetation. The greatest reduction was obtained by spraying at weekly intervals, but a slight reduction was also effected by weekly or fortnightly applications either in June or July. The percentage of infection with the viruses was lower in the sprayed than in the unsprayed plots. While none of the treatments appeared to affect the yield of the plants at the first cropping in the first year of growth, which coincided with the end of the spraying period, the plots that received weekly applications in the first year gave a 30 per cent. increase of yield in the third crop obtained in May of the second year of growth.

Schindler (H.). **Untersuchungen über eine an Cereus grandiflorus Mill. beobachtete Gewebenekrose.** [Investigations on a tissue necrosis observed in *Cereus grandiflorus* Mill.]—*Angew. Bot.*, xix, 4, pp. 505–508, 2 figs., 1937.

Cereus grandiflorus, a valuable medicinal plant extensively cultivated at a Dresden biological institute, was affected in 1936 by tissue necrosis, externally manifested by brown spots, several cm. in length and about 3 mm. in width, on the young shoots. Microscopic examination disclosed a brown discoloration of the epidermis and hypoderm and well-

marked necrosis of the underlying cells of the assimilation parenchyma, the walls of which were brown, the chloroplasts disintegrated, and the cytoplasm completely disorganized. The affected tissue was separated from the healthy by a periderm, and the development of the plants was not impeded. The cause of the necrosis is obscure, but may possibly be connected with disturbances in transpiration due to abrupt temperature and humidity fluctuations.

ARRUDA (S. C.) & GONÇALVES (R. D.). **A 'murcha', uma nova doença da Mamona em S. Paulo.** ['Wilt', a new disease of the Castor Bean in S. Paulo.]—*Biologico*, iii, 8, pp. 232–235, 2 pl., 1937.

An account is given of a disease of castor bean [*Ricinus communis*] which, although it has only been observed so far in two localities of São Paulo, Brazil, may eventually prove to be a major trouble of the crop. The chief symptom is a wilting of the foliage, usually beginning from the lower leaves and gradually spreading to the apical ones, very frequently affecting only one side of the plant. The condition is accompanied by the development on the stem, most commonly from the top downwards, of dark grey to black necrotic bands, bearing pink or salmon-pink sporodochia, about 1 mm. in diameter, of a species of *Fusarium* [cf. *R.A.M.*, xvi, p. 560], the mycelium of which was always found in the discoloured vascular bundles of the diseased stalks and roots. The root system of infected plants is rotted, and infection is believed to occur through this channel. Castor plants apparently dead may occasionally put forth a few new shoots from soil level, but these are invariably diseased and die more or less rapidly. The constant association of the fungus with the disease suggests that it is the causal organism, and inoculation experiments are now in hand to test this hypothesis. The control measures tentatively suggested include the careful and early roguing out and incineration of all diseased plants, and the eventual development of resistant varieties.

Mention is also made of two other diseases of the castor bean in São Paulo which are now being investigated, and one of which is apparently caused by a species of *Ceratostomella*, and the second by a species of *Phytophthora* closely resembling *P. parasitica* [ibid., xv, p. 378].

FERGUSON WOOD (E. J.). **Some anatomical and cytological studies on Fiji disease of Sugar-Cane.**—*Proc. roy. Soc. Vict.*, N.S., xlix, 2, pp. 308–313, 4 figs., 1937.

An anatomical and cytological study of Fiji disease of sugar-cane [*R.A.M.*, iii, p. 606; xvi, p. 205, and next abstract] showed the presence of five regions in the stem galls, (1) protoxylem vessels and lacuna, (2) primary metaxylem vessels, sometimes hypertrophied, (3) the lignified, pitted cells forming a tracheidal tissue surrounding the bundle and for which the name 'pseudotracheid' is suggested, (4) a hypertrophied phloem, and (5) the pseudoparenchymatous tissue lying chiefly between the phloem and the sclerotic tissue, and consisting of equidiametrical cells with large, rapidly dividing nuclei which give rise to the pseudotracheids and sieve-tubes. Galls are characteristically present in the micro-bundles of the leaves, where they produce hypertrophy of the

phloem, a pseudoparenchyma consisting of a few cells, and asymmetry of the xylem.

Contrary to Kunkel's view that the condition is a phloem disease, the author regards it as essentially meristematic, and adduces a number of facts in support of this view. For instance, in the diseased tissue the sieve-tubes and companion cells are more numerous than in healthy tissue, suggesting cambial activity. The pseudotracheids are produced by a metamorphosis of the pseudoparenchyma, which is clearly meristematic, while the sclerotic tissue is homologous with a secondary metaxylem. Rays of sieve-tubes often cut through the sclerotic sheath, and in the galls the phloem may lie outside this, the galls showing no constant arrangement of the tissues.

Observation of living and stained sections showed that the mononucleate pseudoparenchyma cell often becomes multinucleate, inclusion bodies appear, the nucleus disappears as the cell wall thickens, and finally the bodies and cell contents disappear, and a pseudotracheid develops. The bodies appeared to consist of degenerating nuclear material.

Bell (A. F.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1936–37*, pp. 34–41, 1937.

Recent surveys indicate that sugar-cane leaf scald [*Bacterium albilineans*: *R.A.M.*, xv, p. 320; xvi, p. 562] is not present in Queensland south of Townsville; in the dry Cairns-Mossman belt the susceptible varieties Clark's Seedling (H.Q. 426) and S.J. 4 are extensively grown, since natural spread is very slow and adverse seasonal conditions kill off large numbers of diseased stools, thus removing sources of mechanical infection. Downy mildew [*Sclerospora sacchari*: ibid., xv, p. 320] became increasingly prevalent in the Mackay area, and strong measures had to be adopted to check an outbreak on the Meringa Station. Gumming disease [*Bact. vasculorum*: ibid., xvi, p. 277] is now practically non-existent in the southern parts of Queensland. In the Mulgrave area, however, prolonged rains in 1936 favoured spread, and by the end of November the disease had been recognized in 24 farms, and was suspected to be present on at least four more. Spread took place in a north-westerly direction, in the path of the prevailing wind, and was assisted by an illicit transfer of canes from the south to the north side of the Mulgrave River. The boundaries of the quarantine area have been enlarged accordingly. Trials at Bundaberg indicated that P.O.J. 2725, like P.O.J. 2878, confers high resistance to gumming on a very high proportion of its progeny. It was ascertained that the disease is transmissible both naturally and artificially to several varieties of dent and sweet maize.

Fiji disease [loc. cit., and preceding abstract] occurred on several farms in the Isis mill area, and also in the Moreton area, where stricter measures are required as it is not being held in check.

Rind disease (*Pleocyta sacchari*) [ibid., xvi, p. 774] became very important in the Bundaberg–Isis area, where it was almost wholly confined to standover P.O.J. 2878; it was also found on H.Q. 458 at Mourilyan and Hambledon. Incidence appears to bear a close relationship to overmaturity.

Field surveys confirmed the greater incidence of chlorotic streak [fourth disease: ibid., xvi, p. 561] in low, badly drained areas than elsewhere, and showed that secondary spread may be very rapid. In the first varietal resistance trial conducted locally (with 17 varieties) the disease did not appear in the plant crop, but developed in the ratoons, the varieties least affected being Q. 4, Co. 290, P.O.J. 234, B. 147, D. 1135, and Uba with 0, 0, 0, 1, 1, and 1 diseased stools, out of 17, 22, 27, 16, 18, and 20, respectively, and those most susceptible Q. 12, Badila, H.Q. 426, and S.J. 4, with 11, 13, 14, and 16 diseased stools out of 20, 24, 19, and 19, respectively, while the others were intermediate.

ORIAN (G.). **Un nouvel hôte naturel du Bacterium vasculorum (Cobb) Gr. Smith, à Maurice.** [A new natural host of *Bacterium vasculorum* (Cobb) Gr. Smith, in Mauritius.]—*Rev. agric. Maurice, 1937*, 94, pp. 130–131, 1937.

In April, 1935, the young leaves of tiger grass (*Thysanolaena maxima* Kuntze) [*T. agrostis* Nees] growing in Mauritius developed broad, whitish, longitudinal stripes progressing from the base upwards, and dried up from the tip downwards. A yellowish gum was exuded from the vessels of the stalk and sheaths, and isolations yielded a bacterium resembling *Bacterium vasculorum* [cf. *R.A.M.*, xvi, p. 744] which, though not yet definitely identified, produced symptoms typical of *Bact. vasculorum* on inoculation into sugar-cane.

Investigations on Sugar-Cane diseases in Louisiana in 1936–1937.—*Bull. La agric. Exp. Sta.* 288, 12 pp., 1937.

C. W. Edgerton, I. L. Forbes, and P. J. Mills state that in comparative tests, carried out in Louisiana, Co. 290 sugar-cane grown from seed 100 per cent. infected with mosaic [*R.A.M.*, xvi, p. 276] showed reductions in yield, as compared with cane from healthy seed, of 0·8, 16·5, and 6·9 per cent., in 1934, 1935, and 1936, respectively, the corresponding figures for Co. 281 in the four years 1933–6 being 0·8, 9·2, 6·1, and 8·9 per cent.; there is therefore no indication that losses from mosaic are increasing from year to year in these very valuable varieties. C.P. 28–19 showed 13·2 per cent. reduction in yield in 1935, followed by 1·3 per cent. increased yield over the healthy cane in 1936. C.P. 28–70 planted from yellow mosaic cane showed in 1933, 1934, and 1935 a decrease in yield of 31·8, 61·4, and 49·5 per cent., respectively, while infected C.P. 29–320 gave an increased yield of 3·8 per cent. over the healthy in 1935; other varieties were intermediate. The varieties tested thus fall into three groups, (1) those that readily take infection, and do not throw it off, viz., Co. 281, Co. 290, and C.P. 29–291; (2) those that do not take infection readily, but do not throw it off, viz., C.P. 28–11; and (3) those that do not take infection readily, but readily throw it off, viz., C.P. 28–19 and C.P. 29–320.

When healthy seed cane and cane inoculated with red rot (*Colletotrichum falcatum*) [ibid., xvi, p. 206] were grown in comparative tests only P.O.J. 213 and C.P. 807 showed very marked reduction in yield owing to infection, the inoculated cane of the former variety in 1935 yielding 9·2 tons per acre as against 31·7 tons for the uninoculated,

the corresponding figures for the latter variety being 22 and 47·4 tons. C.P. 28–11 showed no reduction.

R. E. Atkinson and C. W. Edgerton state that when sugar-cane stalks were cut and inoculated with a pure culture of *C. falcatum* and then planted, red areas appeared after four days 48 in. away from the point of inoculation. In a further experiment the fungus was reisolated from similar areas which appeared 3 or 4 internodes above the inoculated internode in five days. Living stalks of C.P. 807 cane with the top leaves attached were then placed in a spore suspension of the fungus, and the lowest node cut off under the surface of the water. Two days later, 2 out of 30 pieces from the third and fourth internodes above yielded the fungus. Spores of the fungus were also readily drawn through cane stalks by means of a vacuum pump. These results show that the spores of *C. falcatum* are able to travel through the fibrovascular bundles of sugar-cane and such passage probably occurs when cut stalks become infected at planting.

In immunity studies carried out by I. L. Forbes, P. J. Mills, and C. W. Edgerton 128 stalks of C.P. 28–70 cane showing yellow mosaic were inoculated with green mosaic and 150 stalks of the same variety showing green mosaic were inoculated with yellow mosaic, all the canes being later planted in the field. Every stool resulting from the yellow mosaic stalks inoculated with green mosaic showed yellow mosaic symptoms (with a few plants showing doubtful green mosaic symptoms in the new growth) and vice versa. This result shows that the viruses are distinct, that they do not occur together in the same plant, and that a plant affected by one is immune from the other.

Caminha (A.). **Doenças da Canna de Assucar no Brasil.** [Diseases of the Sugar-Cane in Brazil.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 191–196, [1937].

The information contained in this paper concerning the sugar-cane diseases in Brazil has already been noticed from another source [*R.A.M.*, xvi, pp. 126, 127].

Grove (W. B.). **British stem- and leaf-fungi (Coelomycetes). Vol. II.** —ix+407 pp., 99 figs., Cambridge University Press, 1937. Price £1 1*s*.

This volume completes the work [*R.A.M.*, xv, p. 53], and comprises the sections Sphaerioideae with coloured spores, Nectrioideae, Excipulaceae, Leptostromataceae, and the Melanconiales. The systematic account of 357 pages follows the method of Volume I, with a small addendum to which the present work closes, together with the Latin diagnoses of three new genera and some twenty new species, an epilogue, an index to those Ascomycetes recorded as representing the perfect state of various Coelomycetes, a host index, and an index of binomial names.

Among the fungi well known to plant pathologists, the author's treatment of the following may be mentioned. He maintains both the genera *Vermicularia* Fr. and *Colletotrichum* Corda [cf. ibid., viii, p. 268]; in the former the setae are an essential element, often produced in large numbers before the spores are formed; in the latter the

setae are inessential, as it were an afterthought, and may be many, few, or none; *C. gloeosporioides* is accordingly listed, as it was originally described, as *V. gloeosporioides*. The genus *Gloeosporium* is maintained more or less as it appears in Sylloge III, and few of its numerous segregates are recognized. *Sphaceloma rosarum* (Passer.) Jenkins [ibid., xii, p. 96] becomes *G. rosarum* (Passer.) Grove.

The polymorphic fungus mat often recognized as *Hainesia lythri* [ibid., xiv, p. 180] is listed under one of its pycnidial names as *Leptothyrium macrothecium*, and the long list of synonyms established by Shear and Dodge [ibid., i, p. 110] is considered to represent 'a thoroughly optimistic view'.

The author's treatment of *Sphaeropsis malorum* Berk. may prove a difficulty. On p. 17 the species is listed as a valid species with 'spores oblong, continuous, brown, 22 to 32 by 10 to 14 μ'. [This description answers rather to *S. malorum* Peck = *Haplosporella mali* = *Physalospora obtusa*.] On p. 53, *S. malorum* Berk. is cited as a synonym of *Diplodia malorum* Fckl. The author does not accept *D. mutila* [= *P. mutila*: ibid., xvi, p. 543] for *D. malorum*, for he considers it is unlikely that a fungus that is found on apples on the ground should also occur on *Populus* 'because such a change of habitat is contrary to our experience in this country'.

The spelling *Pestalotia* [ibid., viii, p. 605] is adopted, but 'anyone who prefers the double z . . . is at liberty to write *Pestalozzia* and nobody will be one penny the worse'. The author refuses to reverse the practice of 50 years in order to make a generic name *Hendersonia* conform to its original type species, since the inconvenience can be avoided by making *Hendersonia* Berk. emend. a *nomen conservandum*.

The work is the outcome of years of careful study of this difficult group of fungi and constitutes a most valuable contribution to British mycology.

TEHON (L. R.). **Notes on the parasitic fungi of Illinois—VI.**—*Mycologia*, xxix, 4, pp. 434–446, 9 figs., 1937.

In this further instalment of this series [*R.A.M.*, xii, p. 788] the author discusses 14 species of apparently plant-parasitic fungi from Illinois, including one new genus and twelve new species, Latin diagnoses of which are appended. The following may be mentioned. *Mycosphaerella holci* n. sp. occurs on living leaves of broom corn (*Holcus sorghum* var. *technicus*), with innate perithecia, 60 to 100 μ in diameter, cylindrical to clavate asci, 30 to 45 by 8 to 12 μ, and biseriate, hyaline, bicellular ascospores, 12 to 15 by 5 to 6 μ, constricted at the septum, and with the upper cell somewhat larger than the lower. The constant occurrence among the perithecia of pycnidia of a *Phyllosticta*, with somewhat curved, oblong spores, rounded at both ends, and 6 to 7 by 3 to 3·5 μ, apparently referable to *P. sorghina* Sacc., suggests that the latter may be the imperfect spore form. The ascogenous form has several points in common with *Sphaerella ceres* Sacc. reported on sorghum from Italy, the pycnidial stage of which is reported to be *Ascochyta sorghi* Sacc., and may eventually prove to be synonymous with it. *Glomerella vignicaulis* n. sp. was found on dead *Vigna sinensis* [*V. unguiculata*] stems intimately associated with a species of *Cercospora*

described as a new species under the name *C. vignicaulis*. *Macrophoma rubi* n. sp. causes stem lesions on the cultivated Latham raspberry; the pycnidia are black (brown by transmitted light), spherical to markedly applanate, and 135 to 330 μ in diameter; spores are hyaline, continuous, irregularly oblong, obtuse distally and tapered basally, straight or somewhat curved, and 15 to 25 by 4·2 to 6·6 μ (chiefly 18 to 20 by 4·5 to 5 μ). The fungus enters the host at the juncture of leaf and stem, and is obviously parasitic. *Coniothyrium radicicola* n. sp. was isolated from the cortical tissues of dying *Ulmus americana* roots, and *Ascochyta negundinis* n. sp. from leaf spots on *Acer negundo*. *Coniothyrium caryogenum* [ibid., ii, p. 283] was found on *Carya alba*, a new host for this species, and a new record of the fungus for Illinois. A new genus, *Chaetoseptoria* (differing from *Septoria* by its setose pycnidia), is created for *C. vignae*, which forms on the leaves of *V. unguiculata* scattered, membranous pycnidia, 100 to 165 μ in diameter, with an ostiole surrounded by a ring of erect, straight, brown, septate, acute setae, 50 to 165 by 5 to 9 μ; the spores are hyaline, acicular, straight to arcuate uni- to pluri- (usually 3- or 4-) septate, and 18 to 50 by 1·5 to 2·2 μ in diameter.

Jenkins (Anna E.) & Bitancourt (A. A.). **Doenças das plantas causadas por fungos dos generos Elsinoe e Sphaceloma.** [Plant diseases caused by fungi belonging to the genera *Elsinoe* and *Sphaceloma*.] —*Rodriguésia*, ii, Num. esp., (*1936*), pp. 305–313, 1 fig., [1937]. [English summary.]

A brief account is given of the general morphological characteristics of the genus *Elsinoe* and its pleomorphic conidial stage *Sphaceloma* [*R.A.M.*, xi, p. 723 *et passim*], as well as an historical outline of its taxonomy. A brief discussion then follows of the distribution throughout the world of the species of this group—approximately 30—known up to date, which are listed together in a table indicating their hosts, geographical distribution by continents, and the country and date of their earliest known record. The 13 species occurring in South America are grouped together in a second table, which also indicates all the available records of them in literature.

Grillo (H. V. S.). **Lista preliminar dos fungos assignalados en plantas do Brasil.** [Preliminary list of fungi recorded on plants in Brazil.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 39–96, [1937].

Pending the publication, which is expected shortly, of a complete systematic catalogue of Brazilian fungi, the author gives in this paper a preliminary list of all the phytopathogenic fungi that have been recorded in Brazil up to date on plants of economic or ornamental value. The fungi are listed under their respective hosts.

Herbert (D. A.). **Records of Queensland fungi. II.**—*Qd Nat.*, x, 3, pp. 59–60, 1937.

An annotated list is given of six rusts and eight smuts occurring in Queensland, including *Puccinia calendulae* on English marigold (*Calendula officinalis*), which has assumed a virulent form during the last

three years, *P. cinerariae* on cineraria [*Senecio cruentus*] leaves, *P. distincta* on daisy (*Bellis perennis*), and *Uromycladium alpinum* on *Acacia decora*.

SALGUES (R.). **Deuxième contribution à la flore microcryptogamique de l'Ile de Port-Cros.** [Second contribution to the microcryptogamic flora of the Isle of Port-Cros.]—*Ann. Soc. Hist. nat. Toulon*, xx (*1936*), pp. 130–133, [?] 1937.

Among the species enumerated in this list of 71 fungi detected by the writer in connexion with his chemico-phytopathological studies on the Isle of Port-Cros [off the south of France] may be mentioned *Ascochyta oleandri* on *Nerium oleander*, *A. pseudacori* on *Iris germanica*, *A. robiniae* on *Robinia pseud-acacia*, *A. rosmarini* on *Rosmarinus officinalis*, *Cercospora molleriana* on *Arbutus unedo*, *C. myrti* on *Myrtus communis*, *Erysiphe* [*Oidiopsis*] *taurica* [see above, p. 15] on fennel (*Foeniculum vulgare*), *Guignardia cylindrica* on *Platanus orientalis*, *Hendersonia agaves* and *Tubercularia concentrica* on *Agave americana*, *Leptosphaeria helicicola* on ivy (*Hedera helix*), *Metasphaeria vincae* on *Vinca major*, *Microdiplodia iridicola* on *I. germanica*, *Mycosphaerella pistaciae* on *Pistacia lentiscus*, *Ovularia vitis* on vine, *Phyllosticta althaeicola* on *Althaea officinalis*, *P. ficicola* on fig [ibid., xi, p. 268], *P. morifolia* on mulberry (*Morus alba*), *P. oleae* on olive, *Ramularia cynarae* on artichoke (*Cynara scolymus*) [ibid., xi, p. 745], *Sclerotium yuccae* on *Yucca* sp., *Septoria anthophila* on *Hydrangea hortensis*, *S. arbuti* on *Arbutus unedo*, *S. lavandulae* on *Lavandula stoechas* [ibid., xv, p. 257], and *S. scillae* on *Muscari comosum*.

CHAUDHURI (H.), KAPUR (V. S.), BHATIA (K. L.), & ANAND (J. S.). **Diseases of the Tea bush in the Kangra Valley, Punjab, I.**—*Indian J. agric. Sci.*, vii, 4, pp. 565–573, 2 pl. (1 col.), 1937.

Following a brief introductory note on the history, development, and present position of tea cultivation in the Kangra Valley of the Punjab (where drastic measures are necessary to combat the general decline of the industry), the writers describe their investigations from 1930–4 on eight of the many diseases observed and the agents responsible for them. Grey blight (*Pestalozzia theae*) [*R.A.M.*, xvi, p. 798] is widespread and causes considerable loss. Brown spot (*Phoma theicola*) [ibid., iii, p. 4], less common than the foregoing, is characterized by reddish-brown patches on both leaf surfaces. Brown blight (*Colletotrichum camelliae*) is one of the most destructive parasites of tea, attacking the stem as well as the younger foliage. The perfect stage of the fungus (*Glomerella*) [*cingulata*: ibid., xvi, p. 798] has been obtained on artificially inoculated leaves but not in culture. The same organism, together with *P. theicola* and *Pestalozzia theae* (either or both), is commonly isolated from scabbed foliage. Copper blight (*Guignardia camelliae*) [ibid., viii, p. 814] spreads rapidly in high temperatures. The fungus is a wound parasite and confines its attacks to the foliage. On the other hand, *Botryodiplodia theobromae* [ibid., xv, p. 748; xvi, p. 565], the agent of internal root disease, is a vigorous parasite capable

of attacking plants from the soil, through injuries to the aerial parts and through pruning wounds, pruned bushes inoculated by spraying with a spore suspension being killed within six to eight weeks. *Hendersonia theicola* is the cause of a bark disease of minor importance, characterized by a blackish discoloration and roughening of the stems. The light brown, triseptate, narrow oval or subcylindrical spores measure 10 to 13 by 3·5 to 4·5 μ and may extrude germ tubes from any of their cells. *Cephaleuros mycoidea* [ibid., ix, p. 746], though less common in north-west than in north-east India, has been observed on tea plants in the Baijnath Paprola district.

The inoculation experiments undertaken with all the organisms except the two last named gave positive results under controlled conditions.

[TUNSTALL (A. C.).] **Mycological.**—*Rep. mycol., bot., bact. Br. Indian Tea Ass., 1936*, pp. 1–9, 1937.

Further field spraying tests against tea black rot [*Corticium invisum* and *C. theae*: *R.A.M.*, xv, p. 748] in Assam and the Surma Valley showed that many of the untreated bushes that were infected in July, August, and September appeared to have recovered by November. Applications of Burgundy mixture and lime-sulphur to the pruned bushes during the cold weather had no appreciable effect on the reappearance of infection which usually occurred on the same bushes in the next rainy season, but applications during the rainy season had a significant effect on the disease. Bushes sprayed in July, 1935, with 1, 2, and 4 per cent. Burgundy mixture showed, respectively, a year later only 14, 14, and 11 per cent. infection as against 29 per cent. infection for those not sprayed. Lime-sulphur was found to be an excellent but only temporary palliative. In an Assam garden where only the infected bushes were sprayed with 1 per cent. Burgundy mixture, and those that revived were treated a second, and in some cases a third time, infection in the middle of October amounted to only 2·2 per cent., as against 23 per cent. for the untreated controls, while at the end of September bushes in another garden sprayed with home-made lime-sulphur and 1 per cent. Burgundy mixture showed, respectively, 37·6 and 7·8 per cent. infection, as against 70·8 per cent. for the untreated controls.

In a properly designed experiment, carried out in two gardens in July by a scientific officer, bushes sprayed with home-made and commercial lime-sulphur, 1 per cent. Burgundy mixture, and copper lime dust showed, respectively (averages for both gardens in October), 9·3, 7·6, 2·1, and 3·6 per cent. infection, as against 13 per cent. for the unsprayed controls. From the year's experiments it is concluded that the application of 1 per cent. Burgundy mixture during the picking season only to bushes found to be infected, as and when observed, is effective.

Considerable decay of the branches of tea bushes still occurs in spite of improved pruning and picking methods, necessitating direct methods of prevention and cure. In experiments on the protection of wounds from infection 60 per cent. bitumen in a mixture of kerosene (35 parts) and rosin-turpentine (5 parts) gave a good coating that can be applied with a thick brush.

Youden (W. J.). **Use of incomplete block replications in estimating Tobacco-mosaic virus.**—*Contr. Boyce Thompson Inst.*, ix, 1, pp. 41–48, 1 fig., 1937.

The author presents a modification of the method of incomplete blocks described by Yates (*J. agric. Sci.*, xxvi, pp. 424–455, 1936) applicable to the estimation of the infectivity of virus preparations. The method permits the construction of complete blocks of replicates without sacrificing the advantage of incomplete blocks. The application of the method is illustrated in the estimation of the infective power of crystalline preparations of tobacco mosaic virus on plants of *Nicotiana glutinosa*, full data on which, and the requisite computations for the application of the analysis of variance to the data, are given. The standard deviation of a single leaf is nearly 40 per cent. of the average leaf count and affords some indication of the difficulties attending determinations of infectivity.

Youden (W. J.). **Dilution curve of Tobacco-mosaic virus.**—*Contr. Boyce Thompson Inst.*, ix, pp. 49–58, 2 figs., 2 graphs, 1937.

Using the method of incomplete blocks [see preceding abstract] the author investigated the effect of dilution on the infectivity of tobacco mosaic virus protein, prepared according to Stanley's method (omitting treatment with lead subacetate), some crystals isolated by Dr. Stanley also being used. Data for 20 dilution series of tobacco mosaic virus protein are given. The results showed that at concentrations near 0·1 mg. per c.c. the virus protein may be diluted without a corresponding decrease in the number of lesions produced on the leaves of *Nicotiana glutinosa*, while there was considerable evidence that an increase of infectivity may occur after moderate dilution.

The comparison of solutions differing but little in concentration was made possible by use of the method of incomplete blocks.

Matsumoto (T.). **A further note on the serological studies of the Tobacco mosaic bearing malformed flowers.**—Reprinted from *Agric. & Hort.* [*Japan*], xii, 7, 5 pp., 2 figs., 1937. [Japanese, with English summary.]

In further investigations on the virus complex (tobacco mosaic + potato mosaic) causing a malformation of tobacco flowers [*R.A.M.*, xv, p. 610] the author separated the common tobacco mosaic virus from the virus complex, without impairing the infectivity of the former, by the following method. Anti-potato mosaic serum was added to diseased plant juice (1 : 3) until the concentration reached was from 1 : 10 to 1 : 240; the juice and serum was held for 2 hours at 37° C., placed overnight in a cold room, and next morning centrifuged for 30 minutes, the supernatant liquids being inoculated into healthy tobacco plants. The evidence obtained indicated that at serum concentrations of 1 : 10, 1 : 30, and 1 : 60, the potato mosaic virus can be completely absorbed without reducing the infectivity of the common tobacco mosaic virus, though at a concentration of 1 : 10 some of the inoculated plants remained unaffected. At dilutions of 1 : 120 and 1 : 240 the potato mosaic virus was not completely absorbed, and the

juice was still able to produce the composite disease. To separate the active common tobacco mosaic virus from the virus complex in question use should be made of a serum dilution of 1 : 30 and 1 : 60.

PAL (B. P.) & TANDON (R. N.). **Types of Tobacco leaf curl in Northern India.**—*Indian J. agric. Sci.*, vii, 3, pp. 363–393, 10 pl., 1 fig., 2 diags., 2 graphs, 1937.

Five types of tobacco leaf curl [*R.A.M.*, xvi, p. 414], A, B, C, D, and X, were differentiated in the course of the writers' comprehensive studies on this disease in Northern India, where it probably constitutes the most serious obstacle to successful cultivation, being present to the extent of 5 to 10 per cent. in normal years and virtually destroying the crop in an epidemic season such as that of 1934–5. Most of the observations were made on the Pusa H 142 variety. Weekly counts of diseased plants showed the maximum rate of spread to occur at planting-out time towards the end of October and early November, with further heavy increases during the second half of November and the beginning of December, followed by a decline until infection ceased in the second week of January, to be succeeded, however, by another definite rise in March. In 1935–6 the seed was sown in two lots, one in June (of H 142 variety) and the other (comprising H 142 and 177, Adcock, Harrison's Special, and Cash) at the normal time in August. The incidence of leaf curl in the former was about 63 per cent. more than in the latter, suggesting that monsoon conditions favour the activity of the insect vector of the disease [see next abstract]. Leaf curl was extremely rare in the seed-beds, the bulk of infection occurring after transplanting.

All five types of the disorder are marked by general stunting of the plants and reduction of the leaf area, curling of part or all of the leaf blade, vein-banding or thickening and greening of the veins in some or all of the leaves, condensation of the inflorescence with thickening and greening of the veins of the calyx and ovary wall, and transmissibility by grafting, but not by means of infected juice or through the seed. Types A and B are further characterized by profuse greening, enations, and a striking reduction of stature; in the case of A the leaves are small, much curled and thickened, rugose, brittle, and dark green, whereas in B they are larger, only slightly curled, wrinkled, and pale yellowish-green with no thickening or brittleness. Types C and D do not cause such severe stunting as the foregoing and enations are absent; both produce vein-clearing, which is more intense in C than in D and usually accompanied in the former by a few green 'stitches' in the older leaves. The features of type X are very variable, suggesting a mixture of the other forms described, and it was, in fact, synthetically induced in grafting tests with several combinations of pairs of A, B, C, and D. A and B were shown by grafting experiments to be readily separable from C and D by the symptoms developing on *Nicotiana glutinosa*, *Solanum nigrum*, and *Petunia* sp., while A is distinguishable from B, and C from D by the reactions of *N. rustica*.

Discussing the problem of control, the need for further knowledge concerning the alternate hosts of the virus is emphasized. At Pusa, symptoms strongly reminiscent of leaf curl have been observed on

Zinnia elegans, *P.* sp., *Althaea rosea*, *Hibiscus rosa-sinensis*, *Crotalaria juncea*, and *Scoparia dulcis*. In the meantime the roguing of diseased plants immediately following detection and their replacement by healthy ones is recommended. In 1934–5 there was about 19 per cent. less infection in the plots so treated than in the controls. Nursery-beds may possibly be protected from contamination by the insect vector by means of spraying or similar measures, but the most effective method of combating the disease consists in the development of resistant varieties. So far, however, none of those extensively tested at Pusa has shown any marked degree of resistance, but no infection has been observed on *N. plumbaginifolia*, growing as a common weed, which is presumably either resistant or a 'carrier'.

PRUTHI (H. S.) & SAMUEL (C. K.). **Entomological investigations on the leaf-curl disease of Tobacco in North Bihar. I. Transmission experiments with some suspected insect vectors. II. An alternative host of the virus and the insect transmitter.**—*Indian J. agric. Sci.*, vii, 4, pp. 659–670, 3 pl., 1937.

Negative results were given in 1934–5 by all attempts to transmit four types of tobacco leaf curl (A, B, C, and X) [see preceding abstract] from diseased to healthy H 142 plants with the aid of the Capsid bug, *Cyrtopeltis* (*Gallobelicus*) *crassicornis* Dist., but whiteflies (*Bemisia gossypiperda*) conveyed the typical symptoms of the disorder from infected sann-hemp [*Crotalaria juncea*] to sound tobacco plants. The same insect, or a closely related species, is known to transmit leaf curl in Africa [*R.A.M.*, xv, p. 425] and the Dutch East Indies [ibid., xiii, p. 806], so the present observations are of considerable interest in connexion with the possible identity of the Indian form of the disease with that occurring elsewhere.

HILL (A. V.). **Yellow dwarf of Tobacco in Australia. I. Symptoms.**—*J. Coun. sci. industr. Res. Aust.*, x, 3, pp. 228–230, 1937.

Heavy losses are caused in some years in Victoria, New South Wales, South Australia, and southern Queensland by a dwarfing or stunting of tobacco, for which the name 'yellow dwarf' is recommended. The disease usually begins to appear a few weeks after transplanting and affected plants do not recover. In the 1935–6 season, 38 per cent. of the plants in experimental beds at Myrtleford, Victoria, were affected, while at Pomonal, in the same State, the disease reduced the potential yield of the district by 50 per cent. The average reduction in yield caused by the disease in Victoria during the past seven years is conservatively estimated at 10 per cent. More loss is caused in Victoria and southern New South Wales than elsewhere, and the extent of infection in different years appears to be correlated with time of planting and the weather conditions prevailing after transplanting.

As a rule, the first symptom is a rolling under of the margins and a downward bending of the tips of the young apical leaves, which may be dark green and closely packed round the bud; later, the ventral surface appears to be ribbed. Diseased plants are dwarfed, yellowish, and grow very slowly. They usually have a normal number of leaves, but the

stem is often only one-third of the normal length. The leaves are small, and unsuitable for commercial use. The flowers and capsules are normal but few in number. Flowering is contemporaneous with that of healthy plants, but the leaves mature sooner, those on the lowest third of the plant often dying before the seed begins to ripen. The older leaves are rugose, thickened, and even savoy-like, and the margins and tips generally bend down. The roots are less extensive than is the case with healthy plants, and are slightly brown externally and in the phloem region. If suckers develop they are weakly, the young leaves (like those at the apex of the plant) being rolled and bent, and sometimes thick, rugose, and twisted. The symptoms reappear on the new growth in the next spring.

Experimental evidence indicated that the condition is transmissible by grafting and budding and appears to be due to a virus, which is probably insect-borne.

VONG (W. G.). **The entrance and migration of Bacterium solanacearum Smith in Tobacco plants.**—*Ann. phytopath. Soc. Japan*, vii, 1, pp. 14–23, 1 pl., 5 figs., 1 graph, 1937.

Inoculations with potato agar or decoction cultures of *Bacterium solanacearum* on tobacco [*R.A.M.*, xvi, p. 780] stems, root, and leaves were successful only through wounds, and failed when applied to the stomata or water pores. In the case of the stigmas, however, previous injury was unnecessary. The organism assumed a virulent form in milk cultures and was able to attack the unwounded roots [cf. ibid., vii, p. 122]. In young stems and leaves the bacteria first occupied the xylem tubes, whence they migrated to the surrounding tissues, causing extensive disintegration. Bacterial cavities were frequently observed in the stem pith and cortex. The bacteria proceed somewhat more rapidly downwards than upwards in the xylem tubes: 24 hours after the inoculation of young stems at 25° C. the rates of movement downwards and upwards were 0·2692 and 0·2586 mm. per hour, respectively. The minimum, optimum, and maximum temperatures for migration of *Bact. solanacearum* were found to be 15°, 32°, and 40°, respectively.

MILLER (P. R.). **January temperatures in relation to the distribution and severity of downy mildew of Tobacco.**—*Plant Dis. Reptr*, xxi, 14, pp. 260–266, 5 graphs, 5 maps, 1937. [Mimeographed.]

Downy mildew of tobacco [*Peronospora tabacina*: *R.A.M.*, xvi, p. 641] is stated to have been more widespread and destructive in the United States in 1937, especially in Georgia, North and South Carolina, and parts of Virginia, than at any time since its first appearance in 1921. From a survey of 2,000 plant beds it was evident that the extent of mildew damage in a given locality was closely correlated with the earliness of the first signs of infection in the district under observation. The date of appearance of the disease and the resultant injury were also correlated with mean temperatures approaching 62° F. in January, the effect of which, however, may not be fully expressed unless subsequent conditions also conduce to infection. Further observations are necessary, however, to determine the reliability of this method of forecasting future possibilities of damage from downy mildew.

SIMMONDS (J. H.). **The treatment of Tobacco seed-bed covers to prolong their useful life.**—*Qd agric. J.*, xlviii, 2, pp. 112–116, 1937.

In tests with 14 different substances for the prevention of the deterioration and moulding of calico covers used for covering tobacco seed-beds when undergoing treatment with benzol against downy mildew [*Peronospora tabacina*: *R.A.M.*, xvi, p. 284], it was found that the only dressings satisfactory in all respects were alum and lead acetate, and shirlan. The first is the cheaper method, but necessitates immersion of the calico in a solution of alum (1 lb. in 5 galls.) for one day and then in a solution of lead acetate ($\frac{1}{2}$ lb. in 5 gall.) for 5 to 6 hours; $\frac{1}{4}$ lb. of glue size or gelatine may be added to the lead acetate solution as a waterproofing agent. In the shirlan treatment the calico is soaked and kneaded for about half an hour in a mixture made by dissolving $\frac{1}{2}$ lb. shirlan AG in 5 galls. of water. It may be necessary to repeat either treatment each season to make up for the leaching effects of rain.

MILBRATH (J. A.). **An indication of seed transmission of mosaic virus in Tomato seed.**—*Phytopathology*, xxvii, 8, pp. 868-869, 1937.

Four out of 25 Indian Canner tomato seedlings raised from seed planted on 1st November, 1935, collected a month earlier from a mosaic-infested site in Oregon developed symptoms of mosaic, two months later 3 out of 25 from the same source became similarly affected, and after a further six months 5 out of a batch of 677 plants of the same origin likewise contracted infection [*R.A.M.*, xvi, p. 842]. At the close of the 1936 season 11 out of 168 plants grown from seed collected three weeks earlier from an infected plot also developed mosaic, the tendency to the transmission of which would appear from the figures cited here to decline with the age of the seed.

AINSWORTH (G. C.). **'Enation mosaic' of Tomato caused by a virus of the Tobacco virus 1 type.**—*Ann. appl. Biol.*, xxiv, 3, pp. 545–556, 2 pl., 1 fig., 1937.

This is a full account of the author's investigations on the strain of tobacco virus 1 causing 'enation mosaic' in tomato, a preliminary note on which has been noticed from another source. [*R.A.M.*, xv, p. 672]. In addition to the information already given, it is stated that in tomato mechanical inoculation by any of the usual methods invariably results in 100 per cent. infection, the incubation period during spring and summer lasting about seven days. Most of the leaves formed after infection exhibit malformations comprising, at one time or another, almost every type of tomato leaf distortion previously described, and may also produce leafy outgrowths from their under side; in their early development and anatomical structure these enations have been found not to differ essentially from those described by Jensen in *Nicotiana paniculata* and *N. tomentosa* [ibid., xii, p. 538]. Less severely distorted leaves show a mottling of light and dark green indistinguishable from that of typical mosaic. In winter the incubation period of enation mosaic is about three weeks and the condition of the infected plants is similar to that in ordinary tomato mosaic. Reduction of daylight illumination of plants inoculated in April and May to eight hours per day (the approximate

length of a winter day) increased the incubation period from seven days in the controls to ten days. It had, however, a comparatively slight effect on the type of symptoms produced, since enation mosaic was readily distinguishable from ordinary mosaic by severe leaf distortion, although no enations developed. In a second series in May and June, in which the daily illumination of the inoculated plants was reduced to five hours, the plants grew very slowly and the first definite symptoms, a narrowing of the leaves, appeared after twenty days; the symptoms of mosaic and enation mosaic were very similar, the only difference being that the plants inoculated with enation mosaic were very slightly more stunted than those affected with ordinary mosaic. This is considered to indicate that the variation in symptoms is not a photoperiodic effect but is related to the actual rate of growth of the plants. In its action on White Burley tobacco the enation mosaic strain differs from tobacco virus 1 in that it produces necrotic local lesions on the inoculated leaves in three or four days, while tobacco virus 1 does not, and in that on the average only about 50 per cent. of the smaller White Burley plants inoculated with the former develop systemic symptoms, while with the latter it is very unusual for systemic infection not to occur.

In a discussion of the various types of tomato leaf malformations hitherto described, it is pointed out that the appearance of a single leaf may not be sufficient to diagnose the cause of the distortion. It is possible to distinguish several types of malformation according to the causal viruses, but the symptoms overlap to such an extent as to render the different diseases at times indistinguishable. The leaf malformation caused by tobacco virus 1, although of infrequent occurrence when growing conditions are favourable, may at other times, and especially when very young plants are inoculated, be so severe as to result in typical fern leaf. Another type is the fern leaf caused by cucumber virus 1 [ibid., ix, p. 418], which is typically more severe than that of ordinary mosaic and develops independently of the season under average greenhouse conditions. In a letter to the author, Chamberlain informed him that recent investigations have shown that tomato narrow leaf [ibid., xiv, p. 262] is caused by cucumber mosaic virus (cucumber virus 1 type). A third type is malformation caused by enation mosaic, the most unusual character of which is that although the causal virus is allied to tobacco virus 1, distortion is much more severe in summer than in winter.

A comparative study of tomato fern leaf material sent in by Rischkow [Ryjkoff] from Russia [ibid., xiii, p. 808; xiv, p. 130] showed that the virus involved in this condition is identical in its physical properties with standard tobacco mosaic, with which it also agreed by invariably causing systemic chlorosis in White Burley tobacco without the production of local lesions. In winter, severe distortion was produced in tomato, greater than the average with ordinary mosaic, but varying somewhat in degree in individual plants. No distortion occurred in spring and summer. Tobacco plants also were severely malformed in winter and very much less so in summer. These results show that Ryjkoff's virus is a type of tobacco virus 1, very similar to the standard virus and certainly distinct from enation mosaic virus.

Chamberlain (E. E.), Brien (R. M.), Dallas (W. K.), & Taylor (E. T.). **Experiments on the control of Tomato leaf-mould.**—*N.Z.J. Agric.*, lv, 2, pp. 82–88, 1 fig., 1937.

A brief, tabulated account is given of experiments from 1934 to 1936, inclusive, on the control of *Cladosporium fulvum* [*R.A.M.*, xvi, p. 571] on tomatoes in commercial greenhouses at Wellington, New Zealand, the results of which showed that under conditions (high atmospheric humidity and lack of sufficient ventilation) favouring the development of the disease none of the liquid or dust fungicides tested gave complete control. The best and most consistent results were obtained with 0·3 per cent. shirlan A.G. spray, but lime-sulphur plus agral, lime-sulphur plus colloidal sulphur, and lime-sulphur alone were efficient enough to warrant their use. Gas-sulphur alone, having a particle size ranging from 2 to 10 μ, either as dust or spray, caused foliage injury under the conditions of the tests.

Blood (H. L.). **A possible acid seed soak for the control of bacterial canker of the Tomato.**—*Science*, N.S., lxxxvi, 2226, pp. 199–200, 1937.

Previous experiments having shown that bacterial canker of tomato (*Aplanobacter michiganense*) is controllable by fermenting the fruit pulp prior to seed extraction [*R.A.M.*, xiii, p. 478 and next abstract], analytical studies were made to ascertain the properties responsible for the toxicity of the fermented juices to the organism and the possibility of their practical application. The acids most abundantly produced during fermentation were found to be acetic and lactic, 0·35 to 0·58 per cent. of the former and 0·45 to 0·72 per cent. of the latter usually being present after 96 hours. A preliminary test of the efficacy of those acids as seed soaks for the control of *A. michiganense* was accordingly made, aliquot parts of seed extracted from diseased plants being immersed for 3, 6, 12, 24, 48, or 96 hours in 0·15, 0·3, or 0·6 per cent. acetic acid, in 0·3, 0·6, or 1·2 per cent. lactic acid, or in combinations of the respective concentrations of the two acids for the same periods. Corresponding lots of seed were immersed for 21½ hours in copper sulphate (1 lb. per 8 galls. water), for ten minutes in mercuric chloride (1 in 1,000), and for one hour in water heated to 54° C. A portion of the pulp of the same infected fruit was allowed to ferment for 96 hours before seed extraction. None of the treatments adversely affected germination. The following percentages of canker were recorded in field plots planted with seed from each treatment in 1936; untreated, immediate extraction 81·28, acetic acid soaks (all treatments) 0·08, combined acetic and lactic acids 0·225, lactic acid, 0·62, copper sulphate 6·22, mercuric chloride 6·19, hot water 7·73, and 96 hours' fermentation 0·188. In the combined acetic and lactic acid treatment, the maximum incidence of canker developed from seed lots treated with the lower concentrations for shorter periods. No infection occurred in any of the 1,147 plants grown from seed treated with a combination of 0·6 per cent. acetic and 1·2 per cent. lactic acid for any period. Further studies to establish the limits of concentration and effective schedules for the treatment, using acetic acid alone or in combination with lactic acid, are in progress.

Orth (H.). **Untersuchungen über die Biologie und Bekämpfung des Erregers der Bakterienwelke der Tomaten (Bact. michiganense E.F.S.).** [Investigations on the biology and control of the agent of bacterial wilt of Tomatoes (*Bact. michiganense* E.F.S.).]—*Zbl. Bakt.*, Abt. 2, xcvi, 20–23, pp. 376–402, 7 figs., 2 graphs, 1937.

No essential differences in growth habit on 13 appropriate standard media were detected between 13 strains of *Bacterium* [*Aplanobacter*] *michiganense* from Germany [*R.A.M.*, xvi, p. 781] and one from England, but certain strains produced cells of abnormal shape, the lowered virulence of which is suggestive of degeneration. Drastic modifications in the cultural conditions induced varying degrees of teratology in the different strains, relative immutability being correlated with pronounced virulence.

A. michiganense is definitely a wound parasite and failed to attack uninjured roots, leaves, and fruits under experimental conditions. Even the liability of wounded organs to infection rapidly diminishes with progressive cicatrization. Wounded roots were more accessible to infection in sandy soils than in those well provided with humus; in the field destructive attacks are mainly confined to the lighter types of soil. Primary infection by *A. michiganense* takes place through the soil or diseased seed; the agency of the latter, however, seems to be largely indirect and consists in the infestation of the soil by the decomposing seed, leading ultimately to seedling infection. Secondary infection in the field is mainly due to the practice of cutting off the young shoots or nipping them with the fingernail; both knives and hands should therefore be disinfected in 0·1 per cent. mercuric chloride prior to these operations, the same solution being applicable also to the propagating soil and cuttings. Ten days' fermentation of the fruits in the course of seed preparation killed the organism [see preceding abstract], but the hot-water treatment injured the seeds at temperatures over 50° C.

The so-called 'bush' tomatoes, commercially known as 'Immune', 'Resista', or 'Fortschritt', are not as a rule subjected to the above-mentioned pruning process and thus suffer little from bacterial wilt in the field; their freedom, however, is entirely due to the absence of channels of entry for the pathogen since they readily contract the disease through wounds. Five of the commercial varieties, besides Resista, tested in the greenhouse showed a fair degree of resistance, namely, Lieby's Export, Magnum Bonum, Pierette, Protection, and Vesuvius; these are undergoing further trials in infested soil. Of the four wild forms of the tomato—*Solanum racemigerum*, *S. racemiflorum*, *S. humboldtii*, and *S. pruniforme*—similarly tested, the two first-named proved highly resistant to *A. michiganense*.

Zanzibar Protectorate. A Decree to make better provision for the prevention of the introduction and spread of disease destructive to plants. No. 9 of 1937.—6 pp., 1937.

This is the full text of the Plant Protection Decree, 1937 (12th June), providing for the exclusion from the Zanzibar Protectorate of all plant material liable to act as a source of infestation by diseases or pests by the usual means of inspection, treatment, quarantine, control of imports and exports, and other regulations calculated to serve the purpose in view [*R.A.M.*, ii, p. 480].

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DRUMMOND (O. A.). **Notas sobre o combate á septoriose do Tomateiro.** [Notes on the control of septoriosis of the Tomato.]—*Rodriguésia*, ii, Num. esp. (*1936*), pp. 333–336, [1937].

After stating that leaf spot (*Septoria lycopersici*) of tomato [*R.A.M.*, xvi, pp. 113, 279] is common in the Vicosa province of Brazil, where this crop is grown throughout the year, the author gives a tabulated account of a small range of experiments, the results of which showed that in three adjacent lots of 25 plants each the number of fruits produced was increased from 175 in the control plot to 609 in that sprayed with nosprasit and to 441 in that sprayed with 1 per cent. Bordeaux mixture. In a further test in two comparable plots, the total weight of the fruit produced in the plot sprayed five times with Bordeaux mixture was 324·6 kg. and the harvesting period lasted 23 weeks, as compared with 155 kg. and 16 weeks in the plot that received only one application.

GOIDÀNICH (G.). **Das Ulmensterben in Italien.** [The dying-off of Elms in Italy.]—*Z. PflKrankh.*, xlvii, 8, pp. 417–425, 8 figs., 1 map, 1937.

This is an abridged version of the writer's book on the Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*) in Italy [*R.A.M.*, xvi, p. 141], presenting the salient facts concerning the varied (largely economic) uses of the tree, varietal reaction to the fungus, symptoms of the disease and its spread by *Scolytus* spp. and other insects, and control (chiefly by selection).

DOWSON (W. J.). **Bacterium salicis Day, the cause of the watermark disease of the cricket-bat Willow.**—*Ann. appl. Biol.*, xxiv, 3, pp. 528–544, 1 pl., 1937.

Details are given of inoculation experiments from 1934 to 1936, inclusive, at Cambridge with pure cultures of the organism (*Bacterium salicis*) [*R.A.M.*, xii, p. 60; xiv, p. 400] isolated from the sap of willow shoots exhibiting symptoms of the watermark disease as described by Day [ibid., iv, p. 321]. An approximately two-year-old tree inoculated in the stem in November, 1934, failed the following spring to produce new growth from four shoots above the inoculation points, while all the other buds on it opened and developed normally until at the end of

May a number of leaves all over the tree suddenly wilted, became discoloured, and the affected shoots died back. New shoots were affected in a similar manner until the end of July, after which no further die-back was observed; by the end of that summer, although the greater part of the main stem with its branches was dead or dying, there was plenty of apparently healthy growth arising from the base. In 1936 the buds were apparently healthy, but produced shoots which wilted suddenly and died back. In both years the watermark was present in the previous year's wood of shoots bearing healthy leaves, but not in their tips. The organism was re-isolated from this tree in 1935 and used as inoculum for further experiments in that season, in one of which a willow tree was inoculated in the three shoots composing it, and two of these shoots became infected, one dying early in the summer of 1936 after showing typical leaf symptoms. Of two trees inoculated in July, 1935, one showed by the end of September, 1935, a marked discoloration in the wood of the inoculated shoots. Three 6-month-old trees in pots, inoculated in July, 1935, exhibited a striking reaction to inoculation during the same year, but in 1936 developed normal foliage and showed no further sign of disease.

These results are considered to confirm Day's work, with the exception that, while in the pollard tree inoculated by Day one branch became typically watermarked the same season, in the author's experiments the typical symptoms did not appear until the following season, eight months later; trees inoculated as early as March, 1936, did not show any sign of the disease up to the time they lost their leaves in November. It is further pointed out that the inoculations were only successful on two- and three-year-old trees, and failed on those six months old. Diseased trees under three years of age have been found only very rarely in nature.

The possibility of trees recovering from the disease is indicated by the fact that two trees at the East Anglian Institute of Agriculture, Chelmsford, which in 1934 showed typical leaf symptoms on some of their branches, produced wholly normal growth in 1935 and 1936, and branches expected to show watermark only contained a dark brown stain in the 1934 wood. Furthermore, two diseased shoots, one from Cambridge and the other from Essex, planted in 1935, failed to give signs of disease either that year or in 1936, with no stain in any of the new shoots. This experiment confirms the observation that the causal organism spreads very slowly radially, and suggests the unlikelihood of the dissemination of the disease by planting obviously diseased setts.

Cultural studies of *Bact. salicis* isolated from *Salix coerulea* showed that it differs very slightly in its action on lactose, dextrin, and inulin from the strain obtained from *S. alba*. It is very similar to *Bacillus tracheiphilus* [*Erwinia tracheiphila*] and to a lesser degree to *B. amylovorus* [*E. amylovora*], its group number being 222.2222022 and its index number 5010–32000–1222. In the appended revised description of *Bact. salicis* it is stated that it is a straight cylindrical rod with rounded ends, arranged singly or in pairs end-to-end, rarely in chains, 0·8 to 1·7 by 0·5 to 0·7 μ for single cells, and 1 to 2·2 by 0·5 to 0·7 μ for pairs, and actively motile by 5 to 7 long peritrichiate flagella. It is Gram-negative, not acid-fast, aerobic. and facultatively anaerobic, does not form spores, produces

acid but not gas in xylose, mannose, galactose, dextrose, sucrose, maltose, raffinose, glycerol, mannitol, and salicin, reduces nitrates, and only has a feeble, if any, diastatic action. On potato a characteristic bright yellow pigment is produced which tends to fade to pale brown in old cultures. As determined by a new method [which is briefly described], based upon acid production from sucrose, its optimum temperature for growth is 29° to 30° C., with a minimum between 5° and 10° and a maximum between 33° and 37°. The thermal death point is 50° to 51° for the *S. coerulea* strain and 51° to 52° for the *S. alba* strain. It withstands drying at room temperature for at least 11 days.

SLEETH (B.) & BIDWELL (C. B.). **Polyporus hispidus and a canker of Oaks.**—*J. For.*, xxxv, 8, pp. 778–785, 2 figs., 1937.

Polyporus hispidus [*R.A.M.*, xvi, p. 292] has been found producing elongated, swollen cankers with a bark-covered sunken area bordered by one or more folds of callus overgrowth, on oaks in the Nehantic State Forest of Connecticut. The appearance of sporophores of the fungus and other features prevented any risk of confusion with the somewhat similar cankers due to *Strumella* [*corynoidea*: ibid., xiii, p. 605]. The fungus entered the heartwood through a dead branch or stub and produced an elongated, semi-oval region of white, crumbly decay, turning waxen-yellow with age. From ring counts of the earliest callus formation, the oldest cankers were shown to have been in process of development for over 30 years in the 60- to 70-year-old trees examined on a half-acre plot. In a 10-per-cent. survey of the 36 acres adjacent to this plot, the relative frequency of cankered oaks varied from 2 per cent. for white (*Quercus alba*) to 8 for chestnut oak (*Q. montana*) and 13 for black oak [*Q. nigra*]. Red (*Q. borealis*) and scarlet (*Q. coccinea*) oaks are also attacked. Of the average of 195 oaks per acre (the oaks constituting 90 per cent. of the stand) 13 (7 per cent.) were cankered. Cankers were observed from ground-level to a height of 35 ft., entailing a loss of the largest and best logs; they ranged from 1 to 14 ft. in length (average 3·2 ft.), and the average extent of advanced and incipient rot beyond the cankers themselves was 1·2 ft. The total loss per acre for the 36 acres surveyed was 2 per cent. of the cordwood and 3 per cent. of board feet volume, while in a selected $\frac{1}{10}$-acre plot these losses amounted to 29 and 33 per cent., respectively. Felling and utilization, where possible, is the best method of control.

MARCHIONATTO (J. B.). **Argentine Republic. The effects of rust on the Poplar groves of the Delta.**—*Int. Bull. Pl. Prot.*, xi, 8, pp. 173–174, 1937.

A survey in 1937 revealed the widespread occurrence, first reported in 1936, of poplar rust (*Melampsora larici-populina*) [*R.A.M.*, xv, p. 618] in the islands of the Delta [Rio de la Plata] in Argentina. The identity of the causal fungus was confirmed by Unamunò in Madrid and Gäumann in Zürich, to whom specimens were sent for examination. Rust outbreaks are frequently aggravated by the simultaneous attacks on the poplars by *Septoria populi* [ibid., xiv, p. 15] and *Sphaceloma populi*.

Wilson (Janet M.). **The structure of galls formed by Cyttaria septentrionalis on Fagus moorei.**—*Proc. Linn. Soc., N.S.W.*, lxii, 1–2, 8 pp., 2 pl., 12 figs., 1937.

Cyttaria septentrionalis causes the formation of galls very varied in shape and size on the stems of *Fagus moorei* in New South Wales, though it does not cause serious damage to the tree. The infection is confined to the primary cortex, secondary phloem, cambium, and secondary xylem, and enlargement is due to an increase in the number of cells most pronounced in the xylem and phloem. The mycelium is distributed evenly throughout the tissue it invades and produces irregularly-shaped haustoria. Infection probably takes place from germinating spores on the young stem before secondary thickening is completed, the mycelium remaining dormant until the beginning of the second year's growth.

Björling (K.). **Blueing fungi found in deposits of green algae on trees.** —*Svenska SkogsvFören. Tidskr.*, xxxv, 3, pp. 250–258, 2 figs., 1937. [Swedish summary.]

In 1934 the writer observed in 11 localities of Sweden the blueing fungi *Cadophora fastigiata, Pullularia pullulans* [see next abstract], *Cladosporium herbarum*, another type of the last named approximating to *Hormodendrum cladosporioides* [*R.A.M.*, xiii, p. 22], and *Alternaria humicola* [ibid., xvi, p. 575] growing in symbiosis with green algae on various trees, mainly pine, birch, and beech. Positive results were obtained in inoculation experiments on pine with these five organisms. *Pestalozzia hartigii* [ibid., xv, p. 618] was also isolated from the trees in eight localities, but not in association with algae. In inoculation tests on pine it produced only a superficial black spotting.

The mycelial elements of the fungi usually entwined one, two, or four algal cells in such a way as to produce very intimate contact between the membranes of the two organisms. In some cases, moreover, the hyphal tips were extended and connected by cup-shaped haustoria to portions of the algal cells (exterior only). Although the exact degree of nutritional interchange between the two partners in this symbiotic association could not be ascertained, the balance would appear to incline in favour of the fungi.

The extensive occurrence of blueing fungi on growing trees probably exposes timber to frequent risks of infection both in the plantation and in storage.

Rennerfelt (E.). **Fungal infection of groundwood pulp. Researches into its sources and its development in the pulp.**—*Pulp Pap. (Mag.) Can.*, xxxviii, 8, pp. 561–568, 1937.

This is an abridged version of the author's comprehensive studies on fungal blueing of groundwood pulp in Swedish paper mills, associated with *Cadophora fastigiata, Pullularia pullulans*, and a large number of other organisms [see preceding abstract], a summary of which has already appeared from another source [*R.A.M.*, xvi, p. 574].

Gaisberg (Elisabeth v.). **Über die Adelopus-Nadelschütte in Württembergischen Douglasienbeständen mit Hinweis auf die bisher hier**

bekanntgewordene Verbreitung von Rhabdocline. [On the *Adelopus* needle-fall in the Württemberg Douglas Fir stands with a reference to the distribution of *Rhabdocline* on the basis of present information.]—*Silva*, xxv, 5, pp. 37–42; 6, pp. 45–48, 1 fig., 1 map, 1937.

Continuing her studies on the needle-fall of Douglas firs (*Pseudotsuga taxifolia* and vars.) caused by *Adelopus* [*gäumanni*] in Württemberg [*R.A.M.*, xvi, p. 507], the writer gives a fully detailed account of the occurrence of the disease in the individual silvicultural districts of the province in relation to the local climatic and ecological conditions. The fungus is gradually spreading northwards and its penetration into other parts of Germany is presumably only a question of time.

The sudden epidemic of needle-fall in May, 1934, was no doubt precipitated by the abnormally heavy rainfall of the four preceding years, followed by exceptionally dry weather at the time of the outbreak. The disease affects trees in the age groups between 10 and 40 years (mostly 20 to 30), generally growing in soils with an abundance of decaying humus provided by a covering of strewn needles and a mixed herbaceous flora. Infection is by no means confined to 'suppressed' members of a stand, but may be found causing complete defoliation of the 'leaders', while sound individuals have been observed in immediate proximity to diseased trees. The fructifications of *A. gäumanni* were everywhere present in profusion, chiefly on the 1934 needles, on which they were visible to the naked eye as narrow, soot-coloured stripes, but also on those dating back to five or even seven years. The honey fungus (*Agaricus melleus*) [*Armillaria mellea*] was found in some of the stands attacked by *Adelopus gäumanni* and may have hastened the normally rather slow course of infection by the latter, but in other cases *A. gäumanni* occurred quite independently of the honey fungus and there is evidently no necessary connexion between the two. Perithecial development in *A. gäumanni* was found to coincide closely with the development of the young shoots, maturing asci being observed in material collected early in May, with ascospore formation in full swing by the beginning of June and proceeding at least until the end of that month; by the close of July reproductive activity was practically at an end.

Rhabdocline pseudotsugae [loc. cit.] also came into prominence in Württemberg in 1934, though it had probably been present in the province since 1931. The symptoms induced by this fungus may be hard to distinguish from those due to *A. gäumanni*, and a study of the fruit bodies may be necessary to establish a reliable diagnosis. Those of *A. gäumanni* are in evidence all the year round in the shape of minute, black points along the stomatal rows, whereas *R. pseudotsugae* only begins to fructify in April and its orange-coloured pustules are readily recognizable in May and June on the under sides mostly of the previous year's needles, though two-year-old material bearing these organs in profusion has also been collected. As elsewhere in Germany, the slow-growing mountain types of Douglas fir from 10 to 30 years old are the chief hosts of *R. pseudotsugae*. In contrast to *A. gäumanni*, the foci of infection by *R. pseudotsugae* are mostly situated in the north of Württemberg, the fungus having probably been introduced into the locality either from the Treves centre or from the Palatinate.

No control measures have yet been devised against either of the fungi under discussion, and the economic advisability of spraying is very dubious.

ROHMEDER (E.). **Die Stammfäule (Wurzelfäule und Wundfäule) der Fichtenbestockung.** [Stem rot (root rot and wound rot) of standing Spruces.]—*Mitt. LandesForstverw. Bayerns*, 23, vii+166 pp., 23 figs., 1937. [Abs. in *Neuheiten PflSch.*, xxx, 5, p. 211, 1937.]

Red rot of spruces in Bavaria falls into two phases, viz., root rot due primarily to *Trametes radiciperda* [*Fomes annosus*: *R.A.M.*, xv, p. 184] and wound rot associated with a number of wound pathogens, including *Polyporus vaporarius* [*Poria vaporaria*: ibid., xiv, p. 803], *Polyporus borealis* [ibid., xv, p. 411], *P.* [*F.*] *hartigii* [loc. cit.], *P.* [*F.*] *pinicola* [ibid., xiv, pp. 193, 795], and *Stereum sanguinolentum* [ibid., xiv, p. 728 *et passim*]. Three external signs of root rot are an increase in girth of the lower part of the trunk, the formation of thicker lenticels, and resin exudation. Furthermore diseased wood gives off a duller sound than healthy in response to blows with the axe. Röntgen rays are employed by cabinet-makers to detect the presence of fungal infection in wood samples. Direct control measures are hardly practicable on a large scale and the application of preventive methods is advocated, including restriction of the spruce stand, selection of suitable sites in relation to the place of origin, planting in soil with a loose texture to facilitate deep rooting, and avoidance of wounds inflicted by human or animal agency, fire, and so forth.

SJÖSTRÖM (H.). **Iakttagelser och undersökningar över snöskyttets (Phacidium infestans) uppträdande pa Tallen i höjdlägen i Norrland och Dalarna.** [Observations and investigations on the development of the snow leaf fall fungus (*Phacidium infestans*) on Pines at high altitudes in Norrland and Dalarna.]—*Svenska SkogsvFören. Tidskr.*, xxxv, 3, pp. 205–249, 10 figs., 1 diag., 4 graphs, 1 map, 1937. [German summary.]

The development of *Phacidium infestans* [*R.A.M.*, xvi, p. 647] on the natural regeneration of pine stands in northern Swedish districts liable to heavy snowfalls is comprehensively discussed in relation to appropriate silvicultural measures for the reduction of injury from this source—complete elimination of the damage probably being impracticable in the circumstances. The origin of the planting material is of great importance, trees from regions with milder climates being unable to withstand the rigours of the northern winter. The time of felling may also play a part in the perpetuation of the fungus in localities experiencing long, snowy winters, immense numbers of spores having been found to accumulate in the crowns of trees cut down from September to December. The mycelium of *P. infestans*, however, is the chief means of dissemination under the snow cover, passing from diseased to healthy plants in characteristic patches. This mode of progression is naturally favoured by dense planting in concentrated groups, a practice that should be abandoned in favour of a more open type. Seedlings growing under trees with wide spreading crowns,

which catch and divert a large portion of the falling snow, are largely free from attack.

Di Micheli (G.). **Una nuova ruggine del Pino austriaco.** [A new rust of the Austrian Pine.]—*Alpe*, xxiv, 7, pp. 277–279, 2 figs., 1937.

The writer recently examined an Austrian pine (*Pinus nigra* var. *austriaca*) shoot from Trieste which was attacked by a blister rust corresponding morphologically with *Cronartium asclepiadeum* [*R.A.M.*, xiv, p. 339]. The aecidial stage of the rust, *Peridermium cornui*, is practically indistinguishable from that of *P. pini* [ibid., xvi, p. 358], and inoculation experiments on alternate hosts of *C. asclepiadeum* are in progress definitely to determine the identity of the Austrian pine parasite. The growth in diameter of the affected organs (mostly lateral branches) ceases and an asymmetrical appearance is produced, followed by the development of cankers over the diseased areas, desiccation, and gradual necrosis. Fresh crops of aecidia are produced annually in May and June. In cases of stem infection the entire tree should be destroyed, otherwise it is sufficient to cut away the diseased branches; care should be taken to keep the plantings free from alternate hosts of the rust.

Bailey (I. W.) & Vestal (Mary R.). **The significance of certain wood-destroying fungi in the study of the enzymatic hydrolysis of cellulose.**—*J. Arnold Arbor.*, xviii, 3, pp. 196–205, 1 pl. (facing p. 206), 3 figs., 1937.

In cut, exposed tissues of 114 species in 88 genera and 36 families of the gymnosperms and angiosperms the authors found wood-destroying fungi whose colourless hyphae perforated and progressed within the secondary walls of the tracheal cells and fibres. During their stages of elongation, the hyphae were extremely tenuous filaments which dissolved correspondingly minute elongated cavities, either cylindrical with conical ends or biconical, and of remarkably constant angularity. Enzymatic activity progressed parallel to the long axis of the fibrils and chain molecules of cellulose (which are generally recognized to be orientated approximately parallel to the long axis), or at an angle of from 20° to 25° to this axis.

Most of the specimens examined showed delicate, colourless hyphae and coarse, dark brown hyphae connecting with them. Both types were septate and showed no obvious clamp-connexions. The coloured hyphae were sometimes largely confined to the lumina of the rays and wood parenchyma, while at other times they occurred chiefly in the lumina of the vessels, fibre-tracheids, or libriform fibres. As the cavities formed by the colourless hyphae enlarged, the hyphae became dilated and encrusted with granular material. The vessels were occasionally attacked by the colourless hyphae, but the ray and wood parenchyma seldom, if ever. The fungi frequently dissolved the central layer of the secondary wall, leaving the inner and outer layers intact, suggesting that enzymatic activity may be retarded or inhibited in walls and layers that are very intensely lignified. They are regarded as ubiquitous forms attacking the vascular and fibrous tissues of the higher plants

when cut and exposed to the air, and are considered highly significant from a physico-chemical point of view.

In a note added to the paper it is stated that a specimen of *Acer rubrum* attacked by *Brachysporium* showed helically orientated cavities dissolved by the hyphae, and that Dr. D. H. Linder considers the fungi discussed to be Pyrenomycetes or imperfect stages of this group.

Bose (S. R.) & Sarkar (S. N.). **Enzymes of some wood-rotting Polypores.**—*Proc. roy. Soc.*, Ser. B., cxxiii, 831, pp. 193–213, 1937.

In the tests described in this paper the authors studied the enzymic activity of *Polyporus ostreiformis*, *P. zonalis*, *Polystictus hirsutus*, *P. sanguineus*, *P. leoninus*, *Trametes cingulata*, *T. lactinea*, and *Daedalea flavida*, all of which, to ensure comparable results, were grown in 2 per cent. malt extract solution with a P_H value of 6·8. Using the latest methods of determination, they found that the amount of enzymes in the substratum (extracellular enzymes) was much larger than that of the corresponding intracellular enzymes at all the stages of growth studied in pure culture, namely, in young mycelium, in old mycelium just before the production of fruiting bodies, and in the fruiting stage. This is interpreted as indicating that the major portion of the enzymes produced by the organisms is secreted into the substratum to convert the food materials into an available form. With the exception of catalase, it was shown that the activity of the enzymes was greater in the first than in the other two stages. The carbohydrases, the presence of which was established, included invertase, raffinase, maltase, amylase, emulsin, hemicellulase, cellulase, pectinase, and ligninase, but not lactase or zymase. Catalase was found in all cases as intracellular enzyme, and laccase was present in *P. sanguineus*, *D. flavida*, and *T. lactinea*. Lipolytic and proteolytic enzymes were also found in small quantities.

In tests on mango wood blocks, *P. ostreiformis* [*R.A.M.*, xii, p. 551] was found to be the most active wood-rotting species of the eight that were studied; like *P. zonalis*, *Polystictus leoninus*, and *T. cingulata*, it was not a rapid lignin-destroyer and possibly belongs to the cellulose-destroying group, whereas *P. sanguineus*, *D. flavida*, and *P. hirsutus* are to a great extent lignin-destroying.

Walker (J. C.). **Injury to Cabbage by lightning.**—*Phytopathology*, xxvii, 8, pp. 858–861, 2 figs., 1937.

Cabbage plants in Wisconsin fields are reported to be liable to injury or destruction in roughly circular spots by discharges of summer lightning, the milder form of damage being observed at the periphery of the affected areas and consisting in the death and collapse of the pith cells and the formation of a hollow region surrounded by a dark brown to black layer of desiccated tissue. Adventitious roots are commonly formed within this cavity, and bud stimulation at the leaf scar below the site of cortical injury (which is usually not appreciable) is a common response of the surviving plants. Plants damaged only in the pith may recover from the temporary shock and head normally, but extensive injury is apt to reduce growth and so diminish yield.

Brenchley (Winifred E.) & Watson (D. J.). **The influence of boron on the second year's growth of Sugar Beet affected with heart rot.**—*Ann. appl. Biol.*, xxiv, 3, pp. 494–503, 2 pl., 1937.

The results of the experiment discussed in this paper showed that when first year sugar beets were transplanted in the autumn from experimental plots at Rothamsted into pots each containing about 25 lb. of sand carefully washed free from boron, all the plants during the second year's growth exhibited characteristic signs of boron deficiency (blackening and death of stem apices and flower buds), independently of whether the plants before transplanting were or were not affected with heart rot [*R.A.M.*, xvi, p. 790] of different degrees of severity. In a parallel series all the plants that survived transplanting to sand and received 0·25 or 0·5 gm. boric acid per pot produced healthy shoots with no deficiency symptoms; the plants that were originally affected with heart rot, and whose main axis was killed, put forth a number of healthy lateral shoots and flowered abundantly. The percentage of plants that failed to survive transplanting was much greater by 50 per cent. in the pots receiving 0·5 gm. boric acid than in those with the smaller dose, suggesting that the heavy dose possibly exerted a toxic action on the plants that were not constitutionally able to start new growth immediately after transplanting. The addition of boron did not improve the condition of roots originally affected with heart rot, as these were irremediably damaged. These results indicate the possibility of obtaining more or less normal yields of sugar beet seed from crops reserved for seed but affected with heart rot, by planting them in soil containing an adequate supply of boron or, if the soil is deficient in this element, by applying to it small amounts of boron compounds.

Action of boron on cereals. Action of boron on roots and tubers.—*Rech. Fertil. Sta. agron., Minist. Agric., Paris*, x, pp. 137–143, 1937. [French. Abs. in *Chem. Abstr.*, xxxi, 19, p. 7171, 1937.]

In a series of studies on the influence of boron on various agricultural plants in France, H. Burgevin found that the application of 10 kg. boric acid per hect. to sugar beet fields is adequate for the control of heart rot [see preceding abstract] and exercises no immediately harmful action on the following cereal crops. Caution is indicated in the use of boric compounds, since the cumulative effects of boron may be injurious; the margin between an effective and a toxic dose is comparatively narrow. C. Brioux and E. Jouis found in pot tests that 10 kg. sodium borate per hect. suffices for the control of heart rot and that the amount applied should not exceed 20 kg. G. Joret and H. Malterre observed that boron may either exert no action or depress the sugar beet yield in the absence of heart rot in the loam soils of Santerre. J. Garola found that boron affords some protection against heart rot but does not influence the average root weight.

Gram (E.). **Afsvampingsundersøgelser. V. Runkel- og Sukkerroefrø.** [Investigations on seed disinfection. V. Mangold and Sugar Beet seed.]—*Tidsskr. Planteavl*, xlii, 2, pp. 250–284, 2 graphs, 1937. [English summary.]

Full details are given of the further trials in the control of root rot

of mangolds and sugar beets [*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*] in Denmark by means of seed disinfection during the decade that has elapsed since the publication of a previous report on this subject [*R.A.M.*, vi, p. 72]. Most dealers now supply seed treated by the semi-dry method, so that the bulk of the 3,000 tons sown annually is insured against the pathogens in question at an estimated cost of Kr. 40 to 50 per ton. The losses due to root rot, which was previously shown to assume a virulent form about one year in every three, are apt to be under-estimated, and the results of these experiments leave no doubt as to the beneficial effects of seed treatment, not only on seed-borne organisms but also on those infesting the soil, in the great majority of cases. The most reliable data in yield determinations were secured by sowing the seed-clusters in ten replicate flats for each fungicidal dosage. The same lot of seed was used in successive tests, which were carried out in lime-deficient soil. During the winter the boxes were placed in a greenhouse, and in the spring dug in north of a hedge; summer experiments were a failure owing to favourable germination conditions. The dosage of a given fungicide recommended for practical use is fixed at a round figure near the optimum concentration. The admixture of water with disinfectant dusts (6 to 24 l. per 100 kg. seed) was originally introduced on hygienic grounds but has further been shown to increase the efficacy of the treatment.

In these experiments abavit B dust (750 to 1,000 gm. per 100 kg. seed) [ibid., viii, p. 515] failed to give adequate control. Betanal liquid [loc. cit.] was effective at a strength of 7·5 per mille (two hours' immersion). Betasan dust (with an admixture of water as indicated above) gave excellent results at a strength of 600 to 800 gm. per 100 kg. seed. Among other highly satisfactory treatments may be mentioned one hour's immersion in 4 to 6 per mille dahmit [ibid., xi, p. 117], 2 per mille germisan, 5 or 2 per mille sanagran [ibid., xv, p. 769], 2 to 3 per mille tillantin dansk [= ceresan-nassbeize], and dusting with an admixture of water with the same preparation (600 gm.) or tillantin 1875 [= ceresan U.T. 1875] at a concentration of 800 gm. per 100 kg. seed.

PIERCE (W. H.). **Legume viruses in Idaho.**—*Phytopathology*, xxvii, 8, pp. 836–843, 2 figs., 1937.

During 1935 and 1936 a number of leguminous plants affected by virus diseases were collected in Idaho and test inoculations made with material from these plants on disease-free seedlings of Stringless Refugee Green beans and Asgrow 40 and Perfection peas in order to identify the viruses concerned. Most of the hosts proved to be affected by more than one virus, though one was liable to predominate, e.g., pea virus 3 [*R.A.M.*, xvi, p. 791] on red clover (*Trifolium pratense*), bean (*Phaseolus vulgaris*) virus 2 [ibid., xv, p. 418] on white and yellow sweet clovers (*Melilotus alba* and *M. officinalis*) (indicating the importance of these alternate hosts in the overwintering of the viruses concerned), and pea virus 3 on peas. Of the local pea and bean viruses, the most important from an economic standpoint appear to be pea virus 3 [loc. cit.], bean virus 1 [loc. cit.], and curly top of sugar beets [ibid., xvii, p. 7], which may completely destroy susceptible bean varieties in years when the beet leafhopper [*Eutettix tenellus*] is prevalent. Red

clover was also attacked by bean virus 2, lucerne virus 2 [ibid., xiii, p. 489], and white clover (*T. repens*) virus 1 [ibid., xv, p. 418] (one plant only). Pea virus 3, lucerne virus 2, and white clover virus 1 also infected the sweet clovers, the first-named further being pathogenic to alsike clover (*T. hybridum*) and white lupins (*Lupinus albus*), while yellow trefoil (*Medicago lupulina*) was susceptible to white clover virus 1. Pea virus 1 [ibid., xvi, p. 651] occurred twice only, both times on peas.

Bremer (H.). **Krankheiten und Schädlinge der Küchenzwiebel.** [Onion diseases and pests.]—*Nachr. SchädlBekämpf., Leverkusen,* xii, 3, pp. 169–189, 15 figs., 1937. [English, French, and Spanish summaries on pp. 197, 201–202, 205–206.]

This paper contains a useful account, supplemented by bibliographical references, of some fungal, bacterial, physiological, and virus diseases of onions with a discussion of appropriate control measures. Most of the work has been noticed in this *Review* from time to time.

Ryžkov [Ryjkoff] (V. L.) & Vovk (A. M.). **A new disease of the Onion (Allium cepa).**—*C. R. Acad. Sci. U.R.S.S.*, xvi, 1, pp. 69–72, 2 figs., 1937.

An account is given of a disease of the onion which was first observed in 1936 attacking large numbers of the plants grown at the Agricultural Experimental Station of Alexeyevka, near Kharkoff. Besides a severe stunting of the bulbs (from an average of 5·08 cm. to one of 2·35 cm. in the Zittau onion), the disease is characterized by a mosaic-like mottling on the leaves, ranging from minute, more or less elongated specks to more or less wide light green or cream-coloured bands, and various malformations of the floral organs, resulting in the production of a very considerably reduced yield in seed (from an average of 5·54 gm. to 0·96 gm. in the authors' tests) the viability of which is also very much diminished (from 76·3 to 46·8 per cent.). Seedlings grown from seeds collected from diseased plants were much weaker than seedlings from healthy onion seeds, and developed a less powerful root system. The diseased bulbs did not reach maturity, and instead of being normally spheroidal they retained an elongated shape; the greater part of those that were stored germinated during the autumn, and failed to survive until the next planting season. Histologically the disease resulted in the loss of differentiation of the mesophyll, the palisade cells being indistinguishable from the cells of the deeper layers, hypoplasia of the stomata, and not infrequent formation of four instead of two guard cells, due to additional divisions. In heavily affected cells intracellular inclusions were found, consisting of homogeneous bodies, of which one or two, seldom more, were observed lying close to the nucleus. The disease was easily transmitted by rubbing the leaves of healthy plants with emery paper wetted with the juice of diseased plants, the incubation period lasting from 10 to 14 days. The disease is stated to differ from yellow dwarf [*R.A.M.*, xvi, p. 724] in that it does not attack the flowers, and is attributed to an undescribed virus.

FLEISCHMANN (R.). **Beobachtungen über das Welken der Linsen.** [Observations on Lentil wilt.]—*Pflanzenbau*, xiv, 2, pp. 49–56, 3 figs., 1937.

Lentils in Hungary, especially in acid soils, are liable to a wilt disease (tentatively attributed by B. Husz to a *Fusarium* [*R.A.M.*, xi, p. 282]), causing a yellow discoloration and shrivelling, often followed by collapse in windy weather. An examination of diseased specimens by [G.] Gentner, of the Bavarian Agricultural Institute, however, revealed no evidence of a fungal or bacterial pathogen, but it is thought that soil bacteria may be responsible. In a germination test of healthy and diseased seeds in 1935, 85 per cent. of the former emerged compared with only 49 per cent. of the latter, 10 per cent. of which subsequently contracted the wilt symptoms. The yield from a stand of lentils raised from healthy seed of the foregoing trial plots amounted to 9·6 dz. [960 kg.] per hect. compared with 6 dz. [600 kg.] from diseased material. It would thus appear practicable gradually to develop a wilt-resistant population by means of mass selection. In this connexion attention is drawn to the superiority of the small-sized lentils over the large types from the standpoint of disease resistance, and some observations are made on the desirability of extending the cultivation of the former.

BEWLEY (W. F.), HARNETT (J.), & WILLIAMS (P. H.). **The control of white plaster mould (Oospora fimicola) on Mushroom beds.**—*Gdnrs' Chron.*, cii, 2642, p. 130, 1937.

The following treatment is recommended for the elimination of *Oospora fimicola* from mushroom [*Psalliota* spp.] beds [*R.A.M.*, xvii, p. 13]. On the first sign of disease, after removing the infected and surrounding casing soil until the underlying compost is uncovered slightly beyond the white infected area, the white infected compost should be removed and replaced by acid peat, moistening thoroughly with dilute acetic acid (1 part $33\frac{1}{3}$ per cent. acid to 7 parts of water by volume) from a syringe, and finally re-covering with fresh casing soil. Where shelves are used and the holes are deep, double thicknesses of newspaper should be placed on the surface of the bed beneath to protect the mushrooms from any acid dripping through. In order to prevent outbreaks of *O. fimicola*, the floor of the house, with which the compost of ground beds comes into contact, should be covered with a thin layer ($\frac{1}{2}$ in. in depth) of acid peat saturated with the above-mentioned acetic acid solution, a 2 gal. can being sufficient to treat 40 sq. yds. through a fine rose. In a block of houses with beds covering 11,000 sq. ft. only 15 areas of infection appeared where this treatment was applied, and the fungus was promptly suppressed by the methods indicated above. Wooden shelves should not only be sterilized with formaldehyde (1 gal. in 49 of water) but also flamed with a large blow-lamp between each crop. The yield from the beds treated by the curative method herein described totalled $2\frac{1}{2}$ lb. per sq. ft., whereas without disinfection it would not have exceeded $\frac{1}{2}$ lb., judging by recent experiences.

BROWN (H. P.). **Mushroom bed invaders. Their habits and the means of control.**—*Agric. Gaz. N.S.W.*, xlviii, 8, pp. 436–439, 6 figs., 1937.

Notes are given on the so-called 'weed fungi' [cf. *R.A.M.*, xvi, p. 15]

most commonly invading cultivated mushroom [*Psalliota* spp.] beds in New South Wales, including *Monilia* [*Oospora*] *fimicola* [see preceding abstract], *Papulaspora byssina* [ibid., xvi, p. 653], ink cap (*Coprinus* spp.), which is common, but not serious, *Pseudobalsamia microspora* [ibid., xvi, p. 86], noted at Sydney, in May, 1937, *Clitocybe dealbata* [ibid., xiv, p. 739], found at Sydney in 1936, and *Xylaria vaporaria* [ibid., xiv, p. 555]. Control is recommended by sanitation and disinfection. All possible sources of infection must be considered, including the composting ground, interior of the house, and the earth floors. All parts of the compost heap must be exposed to full heat, and the composting ground changed at intervals. If infection is suspected to have originated in the composting ground it should also be disinfected with commercial formalin (1 in 50). Casing soil, before being placed on the beds, should be disinfected by heat or with formalin (1 in 50, $\frac{1}{2}$ gall. per cu. ft.). Earth floors should be treated with formalin between the crops. Houses should be fumigated by burning sulphur, using 5 lb. per 1,000 cu. ft. of air space, or sprayed with formalin. Infected beds should be moistened well with formalin before being removed as far as possible from the new beds.

HASHIOKA (Y.). **Relation of temperature and humidity to Sphaerotheca fuliginea (Schlecht.) Poll. with special reference to germination, viability, and infection.**—*Trans. nat. Hist. Soc. Formosa*, xxvii, pp. 129–145, 1 fig., 1937.

In controlled greenhouse experiments a temperature range of 22° to 31°, culminating at 28° C., was found to be very favourable to conidial germination in *Sphaerotheca* [*humuli* var.] *fuliginea*, the agent of a serious disease of Cucurbitaceae [*R.A.M.*, xvi, p. 653] and other plants in Formosa, the minimum and maximum for the process being about 15° and 34°, respectively. In a saturated atmosphere the proportion of germinating conidia varied between 15 and 80 per cent. with the source of the test material, probably averaging about 30 per cent., but in drops of water or dilute sugar solutions germination either did not occur or was very poor. Haustorial formation was most profuse at 28° in inoculation tests on one-week-old Fushinari cucumber seedlings, the optimum temperature for the infection of which was also about 28°, corresponding with the above-mentioned observations on conidial germination. The incubation periods of the fungus at 19·5° to 20·5°, 24° to 28°, and 32° (at which temperature the symptoms are barely perceptible) were found to be 4, 3, and 7 days, respectively. On seedlings under bell jars at a temperature range of 22·5° to 31·5°, germination occurred within 11 hours at saturation point but was more or less sparse in the other relative humidity series (46 to 51, 64 to 67, and 88 to 97 per cent.). In another experiment infection occurred more severely at 96 per cent. air moisture than at 97 or 100 per cent. and at 69 per cent. than at 55 per cent. In viability tests conidia were rapidly killed at the higher temperatures and lower humidities, but at 0° to 4·5° survived 14 days at 76 to 80 per cent. relative humidity, 24 days at 93 to 98 per cent., and 38 days in a saturated atmosphere; and at 10·5° to 15·5° 24 days in a saturated atmosphere. The formation of

conidia was much reduced in a saturated atmosphere but was abundant at 76 to 93 per cent. air humidity.

The bearing of these experimental data on the pathogenicity of *S. humuli* var. *fuliginea* under the prevailing weather conditions in Formosa is discussed. At Taihoku the mean temperature rises during July to a maximum of 28·2°, corresponding with the optimum for the growth of the fungus, and sinks to a minimum of 14·8° in February. Within these limits, therefore, *S. humuli* var. *fuliginea* would be well able to persist throughout the year, but actually it is exposed to greater extremes both of heat and cold during certain seasons. The atmospheric humidity of Formosa falls mostly within the range of 75 to 80 per cent. (minimum and maximum 72·8 and 85·5, respectively); excessively heavy precipitation tends to suppress the growth of the organism on the upper leaf surfaces. It is improbable, however, that such adverse factors are sufficient to prevent the overwintering of the cucurbit mildew in the conidial stage in Formosa, especially in view of its numerous alternate hosts.

François (E.). **Un grave péril. La "mosaïque" du Manioc.** [A serious danger. Cassava mosaic.]—*Agron. colon.*, xxvi, 236, pp. 33–38, 1937.

Up to 1936, cassava mosaic [*R.A.M.*, xvi, pp. 87, 301] was endemic in a mild form in Madagascar, where it was most prevalent on the local or Malgache variety even when grown under the most favourable conditions, though varieties obtained from seeds and those recently introduced on account of their high yield appeared to be immune in all districts. In 1936, however, the disease suddenly became so severe that in many localities the crop had to be abandoned, especially in the north, near Lake Aloatra. In addition to the usual symptoms the affected plants showed dwarfed, twisted stems with very short internodes bearing tiny leaves, and succumbed with the onset of the dry season. In the winter of 1936–7, the disease spread all over the island and even in the best crops, at Aloatra, the Malgache variety showed 100 per cent. infection. At Nanisana the losses amounted to 50 per cent. The most recent plantings were the worst affected. Even varieties previously regarded as immune became slightly affected. The disease is thought to be transmitted by an Aleurodid which was abundantly present on the plants. Further study of the problem is in progress.

Kvičala (B.). **Náchylnosť odrůd Soji ku bakterielni spále, zjištěná umělou infekcí. Předběžné sděleni.** [Susceptibility of Soy-bean varieties to bacterial blight, as determined by artificial inoculations. Preliminary communication.]—*Ann. Acad. tchécosl. Agric.*, xii, 3, pp. 266–271, 4 figs., 1937. [German summary.]

In this note the author states that soy-bean, a new introduction into Czechoslovakia, was severely attacked in several localities by bacterial blight, the causal organism of which was isolated and identified as *Bacterium glycineum* [*R.A.M.*, xv, p. 632]; the disease is thought to have been brought into the country with the seed. Preliminary experiments showed that of the eight soy-bean varieties which were tested,

Bratislavska yellow Sl. 1, Plattska large yellow, and Brnenska Chmelarova SVA 1 were the most resistant to infection.

PETRI (L.). **Trasmissione del 'virus' dell'arricciamento della Vite attraverso i tessuti di una varietà resistente.** [The transmission of the Vine leaf roll virus through the tissues of a resistant variety.]—*R. C. Accad. Lincei*, Ser. 6, xxv, 9–10, pp. 413–416, 1 fig., 1937.

This is an expanded account of experiments already noticed from another source [*R.A.M.*, xvi, p. 587] on the transmission of vine leaf roll from infected Negro amaro vines through the intermediate graft of the resistant Malvasia bianca to a healthy scion of Negro amaro grafted on the Malvasia bianca. The Negro amaro grafts subsequently showed all the external symptoms of leaf roll, while Malvasia bianca remained externally unaffected. The presence of endocellular cordons in the American stocks and in Negro amaro, but not in Malvasia bianca, is stated to afford a further confirmation of the view that these structures are a specific internal symptom of leaf roll [cf. ibid., xvi, p. 704]; it also shows that the virus is transmitted unchanged from the infected vine to the susceptible graft, through the intermediate resistant graft, without the last-named showing any appreciable reaction to local pathogenic activity on the part of the virus. The evidence did not indicate that the resistant variety, though still bearing leaves, exercised any inactivating or attenuating effect on the virus.

GOBBATO (C.). **Principaes pragas e molestias das Vides cultivadas no Rio Grande do Sul.** [Principal pests and diseases of the Vine cultivated in Rio Grande do Sul.]—*Rodriguésia*, ii, Num. esp. (*1936*), pp. 187–190, [1937].

This is a very briefly annotated list of the chief pests and fungal or bacterial diseases of the vine in the South Rio Grande State of Brazil, among which the following may be mentioned: *Dematophora* [*Rosellinia*] *necatrix* [*R.A.M.*, xv, p. 774], *Cercospora viticola* [*C. vitis*: ibid., xv, p. 200], *Coniothyrium diplodiella* [ibid., xvi, p. 775], *Guignardia bidwellii* [ibid., xvi, p. 813], *Septoria ampelina* [ibid., x, p. 296], *Pseudopeziza tracheiphila* [ibid., xiv, p. 285], *Bacterium uvae*, and 'court-noué' [ibid., xvi, p. 654].

KRENEIS. **Auftreten von Coniothyrium diplodiella (Weissfäule) in Jugoslawien.** [The occurrence of *Coniothyrium diplodiella* (white rot) in Yugoslavia.]—*Weinland*, ix, pp. 184–186, 1937. [Abs. in *Neuheiten PflSch.*, xxx, 5, p. 207, 1937.]

Coniothyrium diplodiella [see preceding abstract] appeared in a Yugoslavian vineyard following a light hailstorm in July, 1936, causing partial or complete desiccation of the grapes. The berries fit for utilization yielded a mouldy must, but the flavour of the wine was in no way impaired. Control may be effected by dusting immediately after a hailstorm with a mixture of 60 per cent. sulphur, 32 per cent. vica cement, and 8 per cent. sodium carbonate, or by spraying with 0·5 per cent. potassium bisulphite.

Neergaard (P.). **Aarsberetning fra J. E. Ohlsens Enkes plantepatologiske Laboratorium 1. April 1936–31 Marts 1937.** [Annual report of the phytopathological laboratory of J. E. Ohlsen's widow from 1st April, 1936 to 31st March, 1937.]—11 pp., 1 fig., 1937. [English and Esperanto summaries.]

During the period under review the following fungi were detected among the 2,081 samples of garden seeds tested at the above-mentioned Copenhagen seed-grower's phytopathological laboratory. Severe infection by *Helminthosporium papaveris*, not hitherto reported from Denmark, was observed on the seeds and seedlings of *Papaver somniferum*, *P. paeoniflorum*, *P. mursellii*, and *P. rhoeas* [*R.A.M.*, xv, p. 743]. An *Alternaria* with slender, clavate conidia with long, filiform beaks and a variable number of longitudinal and transverse septa, measuring (beak included) 75 to 210 by 15 to 27 μ (average 136 by 19 μ), was present on 14 varieties of *Zinnia elegans* [ibid., xvii, p. 13]. *Fusarium avenaceum* was found to be seed-borne on 11 samples of several carrot varieties, from which the fungus was isolated and inoculated into seedlings and roots with positive results, producing in the former a wet rot and in the latter a brown, dry type of decay.

Adam (D. B.). **Notes on plant diseases in South Australia during the two-year period, 30th June, 1936.**—*J. Agric. S. Aust.*, xl, 4, pp. 732–734, 1937.

During the two-year period under review [cf. *R.A.M.*, xiv, p. 559] early blight of tomatoes (*Macrosporium* [*Alternaria*] *solani*) [ibid., xvi, p. 419] was of some importance, especially early in the season in ill-constructed greenhouses. *Colletotrichum atramentarium* [ibid., xvii, p. 60] is probably a source of greater damage to tomatoes [ibid., xv, p. 690] than is generally suspected.

A severe outbreak of 'streak' (tomato spotted wilt virus) [ibid., xvi, p. 843] was observed in a bed of green garden peas immediately following a tomato crop, and the same disease severely attacked cinerarias [*Senecio cruentus*], zinnias, and Iceland poppies [*Papaver nudicaule*: ibid., xv, p. 444] in suburban gardens.

Tulips grown from newly imported bulbs were infected in two instances by *Botrytis tulipae* [ibid., xvi, p. 43].

Vines within the last few years have shown symptoms resembling those of court-noué.

Noble (R. J.), Hynes (H. J.), Magee (C. P.), McCleery (F. C.), Birmingham (W. A.), Edwards (E. T.), & Brown (H. P.). **The occurrence of plant diseases in New South Wales, with particular reference to the three-year period ending 30th June, 1936.**—*Sci. Bull. Dep. Agric. N.S.W.* 57, 42 pp., 11 figs., 1937.

Brief, popular notes are given, based for the most part on observations made by the plant-pathological section of the local department of agriculture, on a large number of plant diseases (cereals, grasses, sugar-cane, field and forage crops, vegetables, fruit, and ornamentals) observed in New South Wales during the three years ending 30th June, 1936, special reference being made to the relative importance of the different diseases.

'Purple patch' of wheat and oats (*Rhizoctonia* [*Corticium*] *solani*) [*R.A.M.*, xiii, p. 295; xiv, p. 622], which in 1927 appeared in the South-Western Slopes, was also recorded during 1936 in other districts. The disease has caused serious damage on some occasions, the losses due to it in 1933 ranging from 15 to 35 per cent. Treatment of affected patches with sulphate of ammonia either before planting or when the disease appears in winter gives satisfactory results, particularly with oats.

SHEPHERD (E. F. S.). **Botanical and Mycological Division.**—*Rep. Dep. Agric. Mauritius, 1936*, pp. 30–33, 1937.

During 1936, the trial plot of sugar-cane varieties for resistance to leaf scald (*Bacterium albilineans*) [*R.A.M.*, xvi, p. 590], planted out in Mauritius in 1935, was kept under observation but the final tests have not yet been completed. Another trial for resistance to smut (*Ustilago scitaminea*) [ibid., xvi, p. 516] gave promising results and is to be continued. Tobacco seed-bed treatment with Cheshunt compound reduced black shank (*Phytophthora parasitica nicotianae*) [ibid., xvi, pp. 516, 841]. Further observations indicated that the apparently new virus disease of tobacco recently reported as associated with enations [ibid., xvi, p. 516] is a form of mosaic. What appeared to be leaf curl symptoms [see below, p. 138] were observed on a single tobacco plant, but attempts at transmission by grafting were unsuccessful. Sweet pea (*Lathyrus odoratus*) flowerheads developed wilt (*Glomerella cingulata*) and *Gerbera* sp. showed a similar disease.

ROGER (L.) & MALLAMAIRE (A.). **Notes de phytopathologie africaine.** [Notes on African phytopathology.]—*Ann. agric. Afr. occ.*, i, 2, pp. 187–206, 10 pl., 1937.

In these notes on plant diseases in the French tropical African colonies it is stated that in the Ivory Coast Liberian coffee cherries, even when free from insect attack, are liable to infection by *Trachysphaera fructigena* [*R.A.M.*, xiv, p. 153]. The severe outbreak of 1933 was favoured by a very humid season, but only slight infection occurred in 1934, as a result of prompt control measures which included spraying with casein-Bordeaux. Casein is indispensable to prevent the washing off of the deposit by heavy rain.

Coffee leaves in the Cameroons and in most plantations in the Ivory Coast are infected by *Irenina coffeae* [ibid., xiv, p. 397]; all cultivated species are affected, especially those with wide, thick leaves, such as Liberia and Indénié; *Coffea canephora* is also attacked. Usually little damage is done, but in some cases the trees languish, most of the leaves turn yellow and fall, the fruits dry up and drop, most of the flowers abort, and the crop is lost. Control, when necessary, consists in removing the affected leaves, spraying with casein-Bordeaux mixture, and applying an organic mineral fertilizer rich in nitrogen and potassium.

Macrophoma ensetes Sacc. & Scalia occurred on a *Musa sinensis* [? *M. cavendishii*] fruit in French Guinea, the skin of which was covered with small, black pustules; the superficial, brown-black, ovoid or rounded pycnidia measured 200 to 300 μ in diameter, and the short, hyaline sterigmata bore unicellular, hyaline, elongated, cylindrical spores, which were often irregularly rounded at the extremities and

measured 15 to 23 by 4 to 6 μ. The species differs distinctly from *Macrophoma musae* [ibid., xv, p. 137] in that its spores are narrower, never surrounded with a gelatinous substance, and have no hyaline appendage. It is probably saprophytic and is commonly present both in French Guinea and the Ivory Coast on over-ripe bananas, of which it is one of the rotting agents.

Passiflora quadrangularis fruits in the Ivory Coast were infected by a fungus regarded as *Botryodiplodia theobromae* but having erumpent, hairy pycnidia arranged singly but in close proximity to one another, and spores measuring 25 to 30 by 13 to 16 μ; the striation of the last-named organs recorded by some workers is not a constant character.

Cassava mosaic [ibid., xvi, p. 456] in the Ivory Coast has spread to the northern districts as a result of the use of diseased cuttings.

Other records are: *Cerotelium desmium* [ibid., xv, pp. 259, 779] on *Gossypium punctatum*, *Lasiodiplodia* [*B.*] *theobromae*, *Coniothyriella theobromae* [ibid., xv, p. 830], (?) *Clonostachys theobromae*, and *Fusarium theobromae* App. & Strunk [*F. javanicum:* ibid., iv, p. 569] on cacao pods, *Ustilago zeae* and *Diplodia macrospora* on maize [ibid., xiv, p. 564], *Helminthosporium lycopersici* on tomatoes [ibid., xv, p. 830], *Alternaria brassicae* on *Brassica oleracea*, *Sphaerostilbe* (?) *repens* on debris of undetermined husks, and *Ragnhildiana manihotis* [ibid., xv, p. 344] on cassava, all in the Ivory Coast; *H. oryzae* [*Ophiobolus miyabeanus*] occurred on rice, and *Curvularia lunata* [ibid., xvi, p. 771] on *Cucurbita pepo* fruits in French Guinea.

THORNBERRY (H. H.) & ANDERSON (H. W.). **Some bacterial diseases of plants in Illinois.**—*Phytopathology*, xxvii, 9, pp. 946–949, 1937.

Technical descriptions are given of five bacteria producing brown, necrotic, circular or angular lesions on the leaves of their hosts, viz., *Phytomonas polygoni* n.sp. on *Polygonum convolvulus*, *Phytomonas plantaginis* n.sp. on *Plantago lanceolata*, *Phytomonas columae* n.sp. on Turkish hazel-nut (*Corylus colurna*), *P.* [*Bacterium*] *cichorii* Swingle on wild chicory [*R.A.M.*, v, p. 275], and *P. helianthi* var. *tuberosi* n.var. on *Helianthus tuberosus*.

P. colurnae measures 1·0 to 1·8 by 0·8 to 1·0 μ, occurs in chains, pairs, or singly with rounded ends and irregular forms, uni- to biflagellate, forms an opaque, viscid, colourless growth on dextrose agar, hydrolyses starch, has minimum, optimum, and maximum temperatures and hydrogen-ion concentrations of 5°, 21°, and 35° and P_H 6·1, 7·2, and 10·0, respectively, and succumbs to methyl and crystal violet, dahlia, basic fuchsin, malachite and brilliant greens, phloxine, erythrosine, and acridine yellow at a dilution of 1×10^{-3}.

Bact. cichorii is a short rod, 1·0 to 1·5 by 0·5 to 0·8 μ, in chains, pairs, or singly, with 1 or 2 polar flagella, capsulate, forming on dextrose agar a raised, opaque, dull, smooth, yellow, viscid growth, the colonies being convex with finely granular internal structure and entire margin; gelatine is not liquefied, milk is peptonized, nitrates are reduced and the minimum, optimum, and maximum temperatures and hydrogen-ion concentrations are 12°, 25°, and 35°, and P_H 6·1, 7·2, and 9·0, respectively; the thermal death point is 52°, and the organism is destroyed by the above-mentioned dyes at the same strength.

P. helianthi var. *tuberosi* measures 1·5 to 2·5 μ, occurs in chains and pairs with rounded ends but no irregular forms, is faculatively anaerobic, motile by 2 to 4 polar flagella, produces a butyrous white growth on dextrose agar, does not liquefy gelatine, peptonize milk, or hydrolyse starch, has minimum, optimum, and maximum growth temperatures and hydrogen-ion concentrations of 12°, 25°, and 35° and P_H 4·1, 6·5, and 9·0, respectively, is destroyed by methyl violet, malachite green, and mercurochrome at 1×10^{-5} and by basic fuchsin, methylene blue, and eosin at 1×10^{-3}.

All the organisms were pathogenic to their respective hosts in artificial inoculation tests.

Kent (G. C.). **Some physical, chemical, and biological properties of a specific bacteriophage of Pseudomonas tumefaciens.**—*Phytopathology*, xxvii, 9, pp. 871–902, 1937.

Bacteriophages producing lysis of a strain of *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xv, p. 5; xvii, p. 17] isolated from apple and reisolated after three passages through tomato, were obtained from crown gall on tomato, sugar beet, and marguerite [*Chrysanthemum frutescens*], and from the healthy portions of galled tomatoes, but not from sound plants.

The properties of a single uniform phage isolate were determined during 25 months of continuous culturing in Chester's bouillon [ibid., xiii, p. 152], consisting of 2·5 gm. each of Bacto peptone and C.P. sodium chloride and 1·5 gm. Difco beef extract per l. distilled water. The phage was observed to cause agglutination of the bacteria during the process of lysis. It had a maximum titre of 10^{-11}, was inactivated by ten minutes' exposure to 95° C., retained its lytic action after rapid drying at 50° to 60°, and withstood ageing *in vitro* provided desiccation was prevented. The lytic properties of the phage further resisted exposure to 70 per cent. ethyl alcohol, 1/40 phenol, and 1 per cent. hydrogen peroxide for 6, 1, and 72 hours, respectively, and to 1/3,000 nitric acid and N/64 sodium hydroxide for one hour. Extraction of the phage was not effected by ether, chloroform, acetone, or butyl alcohol. It was not precipitated by ammonium sulphate, but some tests with neutral lead acetate gave positive results. The phage exhibited specificity towards certain strains of *Bact. tumefaciens*, especially those strongly pathogenic to tomato. It appears to be of little therapeutic value [ibid., xvi, p. 370] against crown gall in tomatoes, adsorption on to the bacteria being slow, incomplete, and incapable of producing inactivation of the pathogen.

Pound (F. J.). **Ecuador: its agriculture in 1937.**—*Proc. agric. Soc. Trin. Tob.*, xxxvii, 9, pp. 335–339, 1937.

In this paper, given as a talk before the Agricultural Society of Trinidad and Tobago in September, 1937, the author states that during his recent visit to Ecuador he observed that there has been no serious attempt as yet to control cacao diseases in that country. About 1890, seeds of Trinidad and Venezuelan cacao were imported into the country, where this type of cacao subsequently became highly popular under the name of Venezuelan. It was from this stock that planters found trees apparently resistant to witches' broom [*Marasmius perniciosus*: *R.A.M.*,

xvi, p. 728]. Two of the leading growers planted large quantities of seed of these trees, and though 70 to 90 per cent. of the seedlings died of *M. perniciosus* before they were one year old, the survivors made cacao fields where the Nacional variety failed. The oldest of these trees are now 9 to 10 years of age and show an incidence of brooms ranging from none to hundreds. Some of the resistant trees are large and on one estate about 15 out of a block of 17,000 were observed to be bearing at least 200 fine pods per annum with not more than 10 to 20 brooms. These trees are clearly super-self-compatible and highly valuable. Pods from many of the most resistant trees have been obtained and the resistance of the seedlings is to be tested in Trinidad and Tobago nurseries.

Owing to the rarity of Panama disease [*Fusarium oxysporum cubense*: ibid., ix, p. 45; xvi, pp. 300, 368, 656] in Ecuador, there is a promising future for the local banana industry.

TEMPEL [W.]. **Beispielsversuche zur Förderung der Beizung in Kleinbetrieben.** [Experiments to demonstrate and promote seed treatment in small holdings.]—*Kranke Pflanze*, xiv, 9, pp. 144–146, 1937.

The majority of the replies to a questionnaire concerning the extent and methods of seed-grain disinfection in Hesse-Nassau in 1934–5 having been very unsatisfactory, the writer obtained from three manufacturers a total of 320 disinfection machines (mostly drums, with 15 short disinfection apparatus, valued at a total of RM. 3,000), which were distributed among the villages with the worst records for seed treatment. A striking improvement in the situation was immediately noticeable, the proportion of oats treated in 1936 being 43 per cent. as against 22 per cent. in 1935, and in the following autumn some 432,000 kg. of rye and 368,000 kg. of wheat were disinfected by up-to-date methods. During the succeeding winter the average incidence of *Fusarium* in rye [*Calonectria graminicola*] was 11 per cent., although winter injury due to adverse weather conditions and other causes was very severe in the untreated stands. The estimated increases of yield in the treated rye and wheat crops amounted to 810,000 and 500,000 to 600,000 kg., respectively.

SCHMITT (A.). **Kosten und Wirtschaftlichkeit der Saatgutbeizung.** [Costs and economy of seed-grain disinfection.]—*Dtsch. landw. Pr.*, lxiv, 36, p. 436, 1937.

Now that the cost of cereal seed-grain disinfection has been so substantially reduced (by about 100 per cent. since 1925), it is recommended that German farmers should no longer hesitate to treat their autumn stands against *Fusarium*, which caused immense damage in the winter of 1936–7, necessitating extensive ploughing-up. In this connexion it is further pointed out that the cost of disinfecting rye and wheat amounts to less than 0·5 per cent. of the value of the yield, the corresponding figure for barley and oats being 1 per cent. Thus, the treatment of wheat and rye pays if only 1 out of 200 plants contracts infection and that of barley and oats if 1 out of 100 becomes diseased. When all charges for labour, material, and apparatus are deducted there should be a net profit of RM. 360·50 per 100 zentner [5,000 kg.] of wheat and of RM. 437·50 for the same quantity of rye.

Whiteside (A. G. O.). **The quality of rust-resistant hard red spring Wheats under development in Canada.**—*Cereal Chem.*, xiv, 5, pp. 674–682, 1937.

The three hard red spring wheats, Thatcher, Renown, and Apex, resistant to black stem rust (*Puccinia graminis tritici*) recently made available to western Canadian farmers, are discussed from the standpoint of milling quality on the basis of quality tests. The data so far accumulated indicate that these varieties compare favourably with the standard Marquis, Ceres, and Reward under normal conditions for the production of good milling wheat of the Manitoba Northern type and are distinctly superior in rust epidemic seasons, such as occurred in Manitoba and south-eastern Saskatchewan in 1935, with an estimated loss of upwards of $85,000,000.

Johnson (T.) & Newton (Margaret). **The effect of high temperature on uredial development in cereal rusts.**—*Canad. J. Res.*, xv, 9, pp. 425–432, 2 figs., 1937.

A tabulated account is given of greenhouse experiments in the winter of 1936 and the spring of 1937, in which wheat varieties normally susceptible to stem [black] and leaf [brown] rusts (*Puccinia graminis tritici* and *P. triticina*) and oat varieties normally susceptible to black (*P. graminis avenae*) and crown (*P. coronata avenae*) [*P. lolii*] rusts, were inoculated with these rusts, kept overnight in damp chambers at the favourable temperature of about 65° to 70° F., and then transferred to compartments of the greenhouse kept at more or less constant temperatures, the daily means ranging from between 55° to 59° up to a maximum of 95° to 99°. The results showed that there is an optimum range of temperature for the development of the uredo stage of each of the rusts, above which the vigour of the pustule development decreases progressively as the temperature is higher. Physiologic races of the rusts that at ordinary temperatures produce a '4' type of infection, tend at higher temperatures to develop a '3' type or an 'x' type, while at still higher temperatures the infection types become '2' or '1' or even merely necrotic flecks. Thus a host variety, susceptible at moderate greenhouse temperatures, may exhibit various degrees of resistance at higher temperatures. There was further clear evidence of physiologic races of a rust differing in their sensitiveness to temperature. In black rust of wheat, the cultures obtained by selfing the rust on the barberry for two or more generations were definitely more sensitive to high temperatures than races collected in the field. Brown rust of wheat and crown rust of oats were less tolerant of high temperatures than the wheat black rust, and at 94° the first-named usually failed to produce pustules. Experiments on the reaction of black rust of oats to temperature were too few to permit any definite conclusions.

While no attempt was made to determine the highest temperatures tolerated by wheat and oats, Little Club wheat did not appear to suffer appreciable injury at the highest mean temperature tested (97°), provided the soil moisture conditions were satisfactory. The authors consider that the relatively smaller damage caused in the great plains region by brown rust of wheat and crown rust of oats than by black

rust may be attributable to some extent to the response of these rusts to high temperatures.

Hassebrauk (K.). **Pilzliche Parasiten der Getreideroste. II. Mitteilung.** [Fungal parasites of the cereal rusts. Note II.]—*Phytopath. Z.*, x, 4, p. 464, 1937.

An examination at the Bureau voor Schimmelcultures, Baarn, of the fungal parasites observed by the writer to attack cereal rusts [*Puccinia* spp.] under very humid atmospheric conditions [*R.A.M.*, xvi, p. 237] established the identity of the organisms concerned as *Verticillium album minimum* (A. & R. Sartory & Meyer) Westerdijk, *V. compactiusculum* [ibid., xiii, p. 737], *V. malthousei* [ibid., xv, p. 775], and *Cephalosporium lefroyi* Horne, *V. niveostratosum* and *C. acremonium*, contrary to previous assumption, not being involved. *V. album minimum* is closely related to *V. coccorum*, a parasite of chrysanthemum rust (*P. chrysanthemi*) in Germany [ibid., xvi, p. 677].

Ames (L. M.). **Barberries immune or highly resistant to black stem rust of cereals.**—*Bull. Arnold Arb.*, Ser. 4, v, 11–13, pp. 57–72, 3 pl., 1937.

Particulars are given of the characteristics of 27 species of *Berberis* and *Mahonia* which may safely be grown for ornamental purposes in the United States without risk of contracting black rust (*Puccinia graminis*) and thereby endangering the success of the quarantine regulations for the control of this disease in cereals.

Bryan (W. E.). **Breeding for smut resistance in Arizona-grown Wheat.**—*Tech. Bull. Ariz. agric. Exp. Sta.* 66, pp. 95–124, 4 graphs, 1937.

This is a fully detailed, tabulated account of experiments in breeding wheats resistant to bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*: *R.A.M.*, xvi, pp. 166, 523, *et passim*] in Arizona. The resistant varieties Hussar, Ridit, and Hope, used as parents, possess varying degrees of resistance as judged by the number of resistant and susceptible progenies appearing in the inoculated F_3, resistance being in the order named. No definite number of genetic factors is clearly indicated for any of the resistant varieties. In the Hope × Sonora cross a partial dominance of the susceptibility of the latter over the resistance of the former is indicated.

Under the conditions of these experiments it would appear that a true distribution of the genotypes in a cross in respect of resistance and susceptibility can only be determined by repeated testing of the progenies taken from all classes of the F_3. Nevertheless, the investigations have definitely shown the necessary steps to be taken in breeding for bunt resistance in crosses between resistant and susceptible varieties, the most important being (1) selection of the resistant parent; (2) crossing the resistant parent with the best standard varieties adapted to local conditions; (3) growing a sufficiently large number of F_1 and F_2 hybrids to insure a reasonable F_3 population; (4) inoculation of the seed of each F_2 plant used for growing the F_3 progenies; and (5) the selection of individual plants from zero- and low-infection progenies of the F_3 and later generations until immunity or high resistance has been fixed, care

being taken that the seed used in planting each progeny is thoroughly inoculated with the forms of smut against which resistance is sought. In these experiments some 2,000 hybrid progenies of the F_3 and later generations have been grown, comprising a total of over 80,000 individual plants; of these five have shown sufficient promise to justify testing for possible commercial use, namely 194–12–6 (Ridit×Pusa 4), 389–24 (Ridit×Escondido), and three 1076 selections (Ridit×Hard Baart).

FELLOWS (H.). **The infestation of soil with Ophiobolus graminis and its subsequent increase and spread in the soil.**—Abs. in *Phytopathology*, xxvii, 9, p. 956, 1937.

Field and greenhouse investigations have shown that the establishment of *Ophiobolus graminis*, the agent of take-all of wheat [*R.A.M.*, xvi, pp. 736, 801], in a new area is a slow and uncertain process. Greenhouse soil must contain at least 25 per cent., by volume, of infested soil to produce an appreciable incidence of disease in the succeeding wheat crop; infestation in a 15 per cent. mixture did not increase with four years' cropping. Non-infested soil, contaminated with a water suspension from an infested site, will grow diseased wheat plants in the greenhouse in two years' cropping. Infection did not develop during three years' field cropping, but when the soil was transferred to the greenhouse and cropped two more years, infection appeared. Non-infested soil, inoculated by light, superficial applications of infested soil to simulate wind blowing, did not produce diseased plants during three years' cropping in the field, but when transferred to the greenhouse and cropped for another two years, the disease developed from this source. *O. graminis* did not spread from infested to non-infested soil, placed in contact without mixing, unless wheat roots grew through the adjacent layers, in which case infection was more abundant when the roots spread from the non-infested to the infested soil than vice versa. Infested soils in contact with non-infested often lose their pathogenicity both in the field and in the greenhouse, while the disease may disappear spontaneously from take-all spots in the field. Dead, infected host debris carried infection in the greenhouse but not in the field in the writer's experiments. Spores from perithecia of *O. graminis*, which serve to perpetuate the fungus, are seldom encountered in the Middle West. Cultures on a barley-oats medium afforded a satisfactory field and greenhouse inoculum. The efficacy of crop rotation as a control measure against take-all is due to the elimination of the living wheat roots which assist so materially in the spread of the disease.

FELLOWS (H.). **Effect of climatic conditions on the prevalence of Ophiobolus graminis in the soil.**—Abs. in *Phytopathology*, xxvii, 9, p. 956, 1937.

Ophiobolus graminis, the causal organism of take-all in wheat [see preceding abstract], is not killed in pure culture by Kansas winter temperatures, nor is it influenced either in culture or in nature by abrupt changes from growing to sub-freezing temperatures. The thermal death point of both micro- and macrohyphae is 50° C. Soil infestation is only slightly reduced by high summer temperatures and drought. The abundance of the parasite in infested soil is liable to alteration by various

combinations of moisture, temperature, and soil consistency. Generally speaking, warm, loose soils retain a minimum of *O. graminis* and cool, compact, moist ones a maximum.

RADEMACHER (B.) & GLAESER (H.). **Über die Behebung der Heidemoor- oder Urbarmachungskrankheit auf Kupfermangelböden durch Zufuhr von geringhaltigen Kupfererzen und deren Aufbereitungsrückständen.** [On the elimination of the heath moor or reclamation disease on copper-deficient soils by the addition of ores with a low copper content and their dressing residues.]—*Metall u. Erz*, xxxiv, 15, pp. 402–405, 1 map, 1937.

The results of experiments initiated by the first-named writer in 1930 on the extensive newly colonized Lütjeholm heath in Schleswig-Holstein showed that copper sulphate may be replaced by finely ground ores containing minute quantities of copper and flotation residues for the control of the reclamation disease of oats, vegetables, and fodder crops without any loss of efficacy [*R.A.M.*, xvi, p. 665]. These otherwise worthless materials can thus be advantageously utilized as substitutes for the valuable copper sulphate, a point of no little importance in connexion with the four-year plan for German economic self-sufficiency [ibid., xvi, p. 479]. At a conservative estimate, the total reclamation-diseased area in the north-west and east of Germany covers 50,000 hect., entailing an annual consumption of 1,275 metric tons of pure copper for the copper sulphate treatment at the standard rate of 100 kg. per hect. It is naturally necessary to use larger quantities of the ground ores and residues (1,000 to 2,000 kg. per hect.) than of copper sulphate, but the cost of application should work out at about the same. The materials in question present various other advantages, including the following. The minute particles of copper are uniformly distributed throughout the soil. The copper sulphides, which undergo a slow conversion to sulphates, are less rapidly leached out by rain and ground water than pure copper sulphate and their action is consequently much more protracted. Copper slate contains a great variety of trace elements which are of great value in soils inadequately provided with minerals.

PETCH (T.). **More about Claviceps.**—*Naturalist, Lond., 1937*, pp. 25–28, 1937.

Ergots (*Claviceps* spp.) from various grasses [*R.A.M.*, xvi, p. 447] in England were kept in an air-tight case during winter and planted out on wet sand in April, 1935, when those from *Lolium perenne, Glyceria fluitans, Festuca arundinacea,* and *Arrhenatherum elatius* showed, respectively, 79, 50, 59, and 67 per cent. germination, while nearly 1,100 ergots from *Phragmites communis* were germinated. With few exceptions none had been subjected to freezing, and the result of another experiment confirmed the view that it is not essential to germination, though exposure to the weather during winter did assist this process.

Observations showed that at the beginning of germination the cortex splits longitudinally for a short distance, a semi-circular flap sometimes being turned back. The clava then grows out directly from the internal tissue; no mycelium is produced on the outside of the ergot. The radiating mycelium usually figured for *C. purpurea* at the base of the clava

develops only after the clava has reached full size, and in many of the author's experiments was not found. If the fungus is grown on sand and watered without wetting the head, the head remains cream-coloured or ochraceous. In large specimens the head is evenly subglobose, but in small ones it may be tuberculate. On oatmeal agar growth of the fungus is slow; a sparse covering of short, more or less erect hyphae appear, bearing conidia terminally on short lateral branches. In the author's experiments no morphological character was observed that separated *C. microcephala* from *C. purpurea*.

Ergots are often attacked and almost entirely consumed by insects, especially that on *A. elatius*, most of the examples of which both in 1935 and 1936 were damaged, apparently by a small weevil.

Haenseler (C. M.). **Correlation between winter temperatures and incidence of Sweet Corn wilt in New Jersey.**—*Plant Dis. Reptr*, xxi, 16, pp. 298–301, 1937. [Mimeographed.]

In connexion with a survey of the statistical data relating to winter temperatures in New Jersey from 1910 to 1936, inclusive, the writer discusses the bearing of this factor on the incidence of bacterial wilt of maize (*Aplanobacter stewarti*) [*R.A.M.*, xvi, p. 597]. In 1936, following a very severe winter, with a temperature index of 79·2 for New Brunswick, and also following a season with a low incidence of wilt, the disease was again present only in traces. On the other hand, the pathogen was much in evidence in the State in June, 1937, following an exceptionally mild winter, though apparently below the peak years of 1932–3. There is considered to be no doubt as to the correlation between mild winters and a high incidence of wilt and conversely between low temperatures and slight infection. However, a certain time factor or lag period seems to be involved in the relationship which requires further study before quantitative forecasts of wilt incidence can be reliably made. A single cold winter, for instance, after a period of wilt, may not suffice to reduce the causal organism or its vectors to such an extent as to give the expected control, while one mild winter does not necessarily so increase the pathogen and its carriers as to cause an exceptionally severe outbreak of wilt in the following summer.

Diehl (W. W.). **Ascochyta sorghina Sacc. on Sorghum in Alabama.**—*Plant Dis. Reptr*, xxi, 16, p. 309, 1937. [Mimeographed.]

In August, 1937, the writer examined specimens of sorghum from Alabama with large necrotic areas (up to 12 by 2 cm.) on the leaves bearing numerous pycnidia tentatively ascribed to *Ascochyta sorghina* [*R.A.M.*, xiii, p. 746], not hitherto recorded from North America. The active pathogenicity of the fungus in the material under observation, in contrast to its relatively mild character in Europe, suggests great susceptibility on the part of the local host.

Chapman (H. D.), Vanselow (A. P.), & Liebig (G. F.). **The production of Citrus mottle-leaf in controlled nutrient cultures.**—*J. agric. Res.*, lv, 5, pp. 365–379, 6 figs., 1937.

In the experiment discussed in this paper (conducted from March to 15th September, 1936, in a greenhouse at Riverside, California) rooted

Valencia orange cuttings were grown in nutrient solutions of varying composition. Mottle leaf [*R.A.M.*, xvii, p. 28] was produced by omitting zinc from the solutions, and in plants already affected with this condition the frequent addition to the solution of small amounts of zinc brought about a recovery. Mottle leaf was particularly severe in the cuttings that were grown in full light in the greenhouse (intensity about 80 per cent. of that out-of-doors), while those kept at lower light intensity (about 40 per cent.) were but slightly affected, this agreeing with the observation that in the field the leaves on the south side of citrus trees are usually more mottled than those on the north side. High nitrate content of the solutions appeared in the early stages of the test to favour mottle leaf development, but this observation needs further confirmation. Increases in phosphate appeared to accentuate the mottling and also the development of root rot, but these two conditions did not appear to be necessarily interrelated, since either could develop independently of the other. The results are considered to support the view that zinc is an indispensable plant food element, rather than that this element functions as an antiseptic or corrective.

Laffond (P.). **Les maladies cryptogamiques et physiologiques des Aurantiacées en Algérie.** [The cryptogamic and physiological diseases of Aurantiaceae in Algeria.]—*Bull. Synd. algér. Agrumes*, 7, 69 pp., 1936. [Abs. in *Hort. Abstr.*, vii, 3, p. 250, 1937.]

Among the Algerian citrus diseases described in detail in this publication, with sections on their control largely by Spanish and American methods, may be mentioned gummosis, due to an unidentified species of *Phytophthora* [*R.A.M.*, xvi, pp. 312, 529, *et passim*], mainly affecting lemon, followed in descending order of susceptibility by *Citrus medica*, *C. sinensis*, *C. nobilis*, *C. triptera*, *Fortunella japonica*, and *C. bigaradia* [*C. aurantium*]; collar rot (*Botrytis cinerea*) [ibid., xii, p. 283]; *Polyporus* spp. causing rot and *Diplodia natalensis* [ibid., xvii, p. 27] gummosis of the trunk and main branches and withering of the shoots; psorosis or scaly bark [ibid., xvi, p. 603]; melanosis (*Phomopsis* [*Diaporthe*] *citri*) [ibid., xvi, p. 744 *et passim*]; anthracnose (*Colletotrichum gloeosporioides*) [ibid., xvii, p. 25], lime-induced chlorosis of the leaves [ibid., xvi, p. 741]; mottle leaf [see preceding abstract]; minor leaf diseases due to *Sphaerella* [*Mycosphaerella*] *gibelliana*, *Phyllosticta* spp., and *Septoria limonum* [ibid., x, p. 24]; oleocellosis [ibid., xvi, pp. 300, 601] of the fruit; and blue and green moulds [*Penicillium italicum* and *P. digitatum*: ibid., xvii, p. 26].

Nattrass (R. M.). **Citrus wastage, a reminder.**—*Cyprus agric. J.*, xxxii, 3, pp. 74–78, 1937.

Detailed directions are given showing how the principal source of wastage in Cyprus citrus fruit (*Penicillium digitatum* and *P. italicum*) [*R.A.M.*, xvii, p. 27 and preceding abstract], exported to European markets, can be eliminated by improved orchard and packing-shed practices, wilting in suitably constructed rooms, and proper loading of lorries.

Bartholomew (E. T.). **Endoxerosis, or internal decline, of Lemon fruits.**—*Bull. Calif. agric. Exp. Sta.* 605, 42 pp., 1 pl., 5 figs., 1937.

Further investigations [which are fully described] carried out in California into internal decline of lemons [*R.A.M.*, xvi, p. 313] showed that the first symptom is the formation of desiccation cavities adjacent to the vascular bundles in the peel at the stylar end. The cells collapse and may be destroyed, often changing to pentoses, pentosans, and finally, to gum. The first visible evidence of the disease is a colourless gummy exudate when the peel is cut in the stylar region. In green fruits the first evident internal symptoms consist of pinkish to rust-brown areas in the vascular bundles of the nipple, many of the vessels being clogged with gum. Pink to rust-brown patches may next appear in any part of the albedo, and the cells and juice sacs of the pulp at the stylar end collapse. In certain localities and times of the year the vessels right through the centre of the fruit become discoloured and are filled with gum, though the other parts of the fruit are not seriously affected.

When the fruit has reached the 'silver' stage the loss of water and the collapse of pulp cells and juice sacs at the stylar end continue, more rapidly near the centre than the peel, particularly in the pithy core of the fruit. As the fleshy pulp tissues dry they generally turn pinkish or rust-brown; at this stage parts of the albedo and about one-fifth of the adjoining pulp at the stylar end are affected.

In yellow (tree-ripe) fruit the yellow or orange-yellow colour assumed by the stylar end of affected fruits persists while others are still green. The pulp tissues continue to collapse as long as the fruit remains on the tree. As a rule, when one-third to one-half of the pulp tissues at the stylar end are affected the fruit drops.

The maximum amounts of endoxerosis found in lots of yellow, silver, and green fruits were, respectively, 100, 85, and 60 per cent. Between 1st May and 1st November approximately 10 to 15 per cent. of the fruit picked in southern California is affected. Very slowly and very rapidly growing fruits are most susceptible. The strength of the acid in affected fruits is nearly as high as that of healthy ones, but the quantity is reduced.

Partial defoliation decreased endoxerosis during the summer months immediately following. Trees covered with cheesecloths remained almost entirely unaffected. Spraying with oil to reduce transpiration was not a practicable control method. Tests demonstrated that large amounts of water were removed from the fruits by the transpiring leaves, marked water deficits existing in the fruits. In summer, in the absence of fog, dew, or clouds, lemons begin to contract owing to water withdrawal at about 6 a.m., the process continuing until 5 or 6 p.m.; in winter the corresponding hours are 9 a.m. and 4 to 5 p.m. Affected fruits begin to contract later in the morning and to expand later in the evening than healthy ones. Twigs that had borne affected fruits withdrew an average of little more than one-half as much water from the potometers as did those that had borne healthy fruits. Less gas could also be forced through the former than the latter type of twig. Badly affected fruits floated higher in the washer than healthy ones, usually stylar end up. Gumming spreads into the woody parts of the pedicel and adjacent twig and governs the rate at which water is drawn from

the potometers. Slightly less endoxerosis ensued when the trees were irrigated from overhead than was the case when furrows were used. When lemon trees were grown in tanks those given the minimum amount of water developed much more endoxerosis than those given a medium amount, and those given the maximum amount were slightly more affected than those given the medium amount. No consistent difference was noted between the amounts of endoxerosis shown by the standard varieties Eureka and Lisbon, or between strains of either. The date of a first serious outbreak depends largely on the rainfall of the previous winter and the time of the first hot spell, and the condition was more prevalent on the south than on the north side of the trees, especially when young. Experimental evidence indicated that the chief causal factors inducing the condition are daily protracted water deficits in the tissues affected, high temperatures during active growth, and the presence of substances readily convertible into gum.

OCFEMIA (G. O.). **The probable nature of 'cadang-cadang' disease of Coco-nut.**—*Philipp. Agric.*, xxvi, 4, pp. 338–340, 1937.

Coco-nuts on San Miguel Island (Philippines) were observed in 1931 to be affected by a disease known locally as 'cadang-cadang' or growth failure and involving 25 per cent. of the trees in some parts of the affected estate. The leaves were yellow and chlorotic, developing numerous yellowish, translucent spots which turned orange-yellow. From a distance the crown of the affected trees appeared yellowish-green. The pinnae were narrow and tended to bend over or break in the middle. The leaves gradually became smaller than those of the same age on healthy trees, and the blades of the pinnae of the middle leaves dried out, the leaves dropping prematurely. Infected plants were stunted and produced small, short leaves closely bunched at the end of the trunk. The leaf-dwarfing was followed by a gradual tapering of the trunk which finally appeared as a bare, pointed pole. As soon as the pinnae turned yellow, no further fruits were formed, though spathes were sometimes abundantly produced. The racemes dried out but remained on the tree. No organism was found, but the characteristics of the disease are considered to indicate that a virus may be responsible.

PFÄLTZER (A.). **De bestrijding van topsterfte.** [The control of top die-back.]—*Bergcultures*, xi, 39, pp. 1395–1400, 1937.

Rudin's conservative methods of pruning coffee trees for the control of top die-back [*Rhizoctonia* sp.: *R.A.M.*, xvii, p. 33], while admittedly presenting certain advantages, are not regarded by the writer as altogether satisfactory, at any rate in the Malang district of Java, where the following procedure is recommended. Regular surveys should be made by specially trained coolies for the presence of the disease, in the course of which fairly deep pruning should be carried out in young plantations and in slightly infected old ones, whereas in extensively diseased old plantations the regular excision of necrotic material is the most rational method of treatment, complete control at this stage being in any case impracticable. The best time for a thorough clean-up of the plantations is shortly after harvest. The young growth in old plantations

is exposed to particularly severe risks of infection by top die-back and is unlikely to reach maturity; to avoid loss of crop denser planting or the development of a several-stemmed growth habit should therefore be considered.

YABLOKOVA (Mme V. A.). Анатомическое изучение трахеомикозного увядания Хлопчатника при различных сроках заражения. [Anatomical study of the tracheomycotic wilt of Cotton, in relation to the time of infection.]—*Pl. Prot., Leningr., 1937*, 13, pp. 28–41, 12 figs., 1937. [English summary.]

This is a full report of the author's studies of the mechanism of infection of cotton with *Verticillium dahliae*, an abstract from which has been noticed from another source [*R.A.M.*, xv, p. 800]. The results indicated that inside the host the parasite is restricted to the vascular system, from which it cannot spread radially; this fact explains why infection during the early stages of growth, when the cotton plants are rapidly forming new layers of xylem, is much less dangerous to the crop than at the flower-bud formation stage, when the vascular system is more or less definitely established. It is suggested that the widespread outbreaks of the disease which are frequently observed in the U.S.S.R. in the form of chlorotic spots on the leaves at the time of blossoming are due to mechanical injuries to the roots by cultivation of the soil in the rows at the bud formation phase. Anatomical examination showed the presence of *V. dahliae* in the hypocotylar node of the cotton plants ten days after inoculation of the roots with cultures of the organism. In the author's tests infections were only successful at temperatures between 16° and 19° C., and not at 32° to 36°. Careful removal from the fields of all infected plant material is practised as a control measure against tracheomycosis.

YABLOKOVA (Mme V. A.). О проникновении **Fusarium buharicum** в проростки Хлопчатника. [On the penetration of *Fusarium buharicum* into Cotton seedlings.]—*Pl. Prot., Leningr., 1937*, 13, pp. 86–87, 1937.

The results of the experiments described in this note showed that spores of *Fusarium buharicum* [*R.A.M.*, xvi, pp. 373, 827] sprayed on two-day-old seedlings of the local cotton variety 1450 (highly susceptible) and of the American Upland No. 1306 (highly resistant or immune), penetrated the unwounded cortex of both hosts at the collar. The parasite spread to the other tissues of the susceptible host, eventually reaching the pith [ibid., xv, p. 800], but in the resistant variety its progress was soon inhibited by the death of the invaded areas and the accumulation in the tissues of a substance which was apparently toxic to the fungus. Inoculations of seedlings of both varieties at a later stage of development gave negative results. Further work is in progress to establish the nature of the resistance in the Upland cotton to *F. buharicum*.

MOORE (ELIZABETH J.). **Carbon and oxygen requirements of the Cotton root-rot organism, Phymatotrichum omnivorum, in culture.**—*Phytopathology*, xxvii, 9, pp. 918–930, 1937.

Phymatotrichum omnivorum, the agent of cotton root rot in the United States [*R.A.M.*, xvii, p. 24], was experimentally shown to be

capable of utilizing for nutrient purposes a large variety of carbon compounds, including dextrose, levulose, galactose, maltose, sucrose, lactose, mannite, xylose, inulin, dextrin, soluble starch, potato starch, maize starch, glycerine, and cellulose. Acidification occurred rarely in cultures with glycerine or cellulose as the source of carbon and never in dilute root decoctions or in the controls without carbon, but it took place in all the other carbohydrate media. Growth may occur with or without acidification of the medium. Agar cultures are somewhat more favourable than liquid ones to the development of *P. omnivorum*, and show considerably more rapid acidification in spite of being more highly buffered. The activities of the fungus are checked by anaerobic conditions [ibid., xii, p. 216]; they are stimulated by the presence of 42 per cent. oxygen (in liquid cultures only) but depressed by 10½ per cent. (slightly in agar and markedly in liquid media). Expressing the growth of *P. omnivorum* and the acidification of the substratum as utilization quotients, the averages are much less for liquid than for agar cultures at the oxygen concentrations tested. In submerged cultures the quotients vary directly with the oxygen concentration. In agar cultures the highest utilization quotient occurs in normal atmospheric oxygen, which is near the optimum concentration for exposed mycelium. The metabolic processes of the fungus are thus closely associated with the oxygen supply to the mycelium.

MOORE (J. H.) & RANKIN (W. H.). **Influence of 'rust' on quality and yield of Cotton and the relation of potash applications to control.**— *Bull. N.C. agric. Exp. Sta.* 308, 18 pp., 7 figs., 1937.

Tests [which are described, and the results of which are tabulated] carried out in North Carolina from 1934–6, inclusive, showed that when potash in amounts ranging from 25 to 50 lb. per acre was applied to cotton fields subject to 'rust' [*R.A.M.*, xvi, p. 156] and was used to supplement a fertilizer consisting of 3 per cent. nitrogen, 8 per cent. phosphoric acid, and 3 per cent. potash, applied at planting at the rate of 400 lb. per acre, the resultant cotton plants gave significantly greater yields of cotton, heavier seed, heavier bolls, a higher lint index, a better grade, a longer staple length, a stronger fibre, and a lower percentage of thin-walled fibres than the control plants given the 3–8–3 fertilizer but not the extra potash after planting.

It is recommended that where, as in the locality concerned, groundnuts are grown in rotation with cotton, supplementary potash applications should be made to the usual fertilizer application (except perhaps when as much as 8 per cent. potash is used in the fertilizer) soon after chopping. Though applications of potash effectively reduce rust damage it is suspected that factors other than potash may be involved in the disorder and that further studies may reveal other methods of control.

IVANIĆ (M.). **Beiträge zur Kenntnis eines im Enddarme des grünen Wasserfrosches lebenden Pilzes Blastocystis ranarum spec. nov.** [Contributions to the knowledge of a fungus, *Blastocystis ranarum* spec. nov., inhabiting the rectum of the green aquatic Frog.]— *Cellule*, xlvi, 2, pp. 159–178, 1 pl., 31 figs., 1937.

This is a comprehensive discussion of the cytology, life-history, and

systematic affinities of *Blastocystis ranarum* n.sp. [no Latin diagnosis], a constant occupant of the rectum of the green aquatic frog (*Rana esculenta*) in Yugoslavia. Studies on the genus *Blastocystis* [*R.A.M.*, xvi, p. 462] having hitherto been largely confined to *B. hominis* [ibid., xvi, p. 100], the detection of an allied species in the lower animals (the writer has also observed one of uncertain identity, possibly *B. hominis*, in a cockroach, *Periplaneta orientalis*) is of interest. The genus is considered to be closely related to the Myxomycetes.

ANDERSON (C.), BRUN (G.), & COURSIÈRES (H.). **Note sur le XXII-e cas de pied de Madura observé à Tunis.** [Note on the 22nd case of Madura foot observed at Tunis.]—*Arch. Inst. Pasteur Tunis*, xxvi, 1, pp. 156–159, 1 pl., 1937.

Details are given of a case of 'Madura foot' [*R.A.M.*, xv, p. 21] in a 45-year-old Tunisian native, with observations on the diagnostic complications incidental to this condition. In the present instance the disorder would appear to be of actinomycotic origin (as in 12 previous cases recorded in Tunis), though other fungi have also been reported as agents in the same region.

DUNLAP (A. M.). **Otomycosis.**—*Chin. med. J.*, lii, 3, p. 446, 1937.

A brief note is given on human otomycosis associated with *Aspergillus niger*, *A. flavus*, and *A. fumigatus*, which is stated to be exceptionally prevalent in China [*R.A.M.*, xiv, p. 632] and elsewhere in the Orient.

IKEDA (K.). **Monilia infection of the lungs (bronchomoniliasis.)**—*Amer. J. clin. Path.*, vii, 5, pp. 376–388, 5 figs., 1937.

This is a full discussion of the pathological anatomy of bronchomoniliasis (*Monilia* [*Candida*] *albicans*) in man and in experimental animals, supplemented by an outline of the pathogenesis of the disease, which may, in the writer's opinion, be recognized as a definite clinico-pathological entity [*R.A.M.*, xvi, p. 177].

BRANDT (R.) & ZACH (F.). **Torula histolytica als Erreger einer Pilzerkrankung des behaarten Kopfes.** [*Torula histolytica* as the agent of a fungal disease of the scalp.]—*Derm. Wschr.*, cv, 37, pp. 1180–1181, 1937.

From scales of the seborrhoeic type on the scalp of an 18-year-old girl in Vienna the writers isolated the fungus known as *Torula histolytica* [*Debaryomyces neoformans* or *Cryptococcus hominis*: *R.A.M.*, xvi, p. 610, and next abstract], which is stated to have been described by S. Wolfram and F. Zach as *T. diffluens* n.sp. (*Arch. Derm. Syph., Berl.*, clxx, p. 681, 1934).

CRONE (J. T.), DE GROAT (A. F.), & WAHLIN (J. G.). **Torula infection.** —*Amer. J. Path.*, xiii, 5, pp. 863–880, 2 pl., 1937.

From the spinal fluid of a 25-year-old negro, who succumbed to an attack of generalized torulosis, the authors isolated a species of *Torula* which corresponded in morphological, cultural, and biochemical characters and thermal relations to that described as *Torula histolytica*

[*Debaryomyces neoformans* or *Cryptococcus hominis*: see preceding abstract]. Intraperitoneal inoculation of mice proved to be of great assistance in establishing the etiological diagnosis of the disease.

Dickson (E. C.). **'Valley fever' of the San Joaquin Valley and the fungus Coccidioides.**—*Calif. West. Med.*, xlvii, 3, pp. 150–155, 1937.

Full clinical details are given of five non-fatal cases of the disease known as 'valley fever', which occurs in the San Joaquin Valley of California and is believed to represent a primary acute manifestation (associated with a cold or bronchopneumonia and erythema nodosum) of coccidioidal granuloma (*Coccidioides*) [*immitis*: *R.A.M.*, xvii, p. 36]. The fungus was isolated from all the patients, four of whom contracted the disease spontaneously while the fifth was exposed to infection in the laboratory.

Cavallacci (G.). **Granuloma del limbus da Sporotrichum.** [Granuloma of the limbus due to *Sporotrichum*.]—Reprinted from *Arch. Ottalmol.*, xliv, 7–8, 20 pp., 4 figs., 1937.

Clinical details are given of a case of granuloma of the limbus of the eye in a young man, associated with *Sporotrichum beurmanni* [cf. *R.A.M.*, v, p. 554; xvii, p. 39] and following injury from a willow branch. Inoculation experiments on laboratory animals gave positive results. Particular interest attaches to the case under observation, not only by reason of the very unusual site involved, but also because of the rarity of ocular sporotrichosis in general in Italy.

Benatar (R.). **Contribuição ao estudo e tratamento das mais communs doenças de Roseiras.** [Contribution to the study and control of the more common diseases of Roses.]—*Rodriguésia*, ii, 8, pp. 9–23, 9 pl., 1937.

This is a very brief, popular account of the more common diseases of the rose occurring in the Districto Federal of Brazil, together with recommendations for their control. The diseases dealt with include mildew (*Sphaerotheca pannosa*), rust (*Phragmidium subcorticium*) [*P. mucronatum*], black spot (*Diplocarpon rosae*, in the imperfect stage only), grey spot (*Mycosphaerella rosigena*) [*R.A.M.*, xi, p. 517], and leaf spots due to species of *Cercospora*, including *C. rosicola* and *C. hyalina* [ibid., xv, p. 59], *Septoria rosarum*, and *Phyllosticta rosae.*

Schmidt (H.). **Auffällige Pilzkrankheiten im Jahre 1936.** [Remarkable fungous diseases in the year 1936.]—*Kranke Pflanze*, xiv, 9, pp. 141–144, 1 pl., 1937.

The spring of 1936 was marked by the epidemic occurrence in German horticultural establishments of a number of fungous diseases ordinarily causing little or no damage, among which the following may be mentioned. Tulip 'fire' (*Botrytis*) [*tulipae*: *R.A.M.*, xvi, p. 43] was prevalent on outdoor tulips, while peonies and snowdrops were attacked by *B.* [*paeoniae*: ibid., xv, pp. 99, 733] and *B.* [*galanthina*: ibid., xv, p. 442], respectively. Lilies of the valley [*Convallaria majalis*] were extensively damaged by anthracnose, due to a species of *Gloeosporium*. *Heterosporium gracile* [? *Didymellina macrospora*] was responsible for

severe injury to iris and gladiolus plantings [ibid., xvi, p. 751], the blackening of carnations (*H.* sp.) caused heavy losses, while species of the same genus occurred on exceptional hosts, such as *Funkia* and *Polygonatum*. Gladioli were also infected by *Septoria* [*gladioli*: ibid., xvi, p. 563], azaleas [*Rhododendron*] (especially the Petrick varieties) by *S. azaleae* [ibid., xiii, p. 207], phlox by *S. phlogis* [ibid., xvi, p. 256], and privet by *S.* sp. and *Myxosporium cingulatum* [*Gnomonia cingulata*: ibid., v, p. 493]. A very serious disease of *Primula malacoides* was caused by *Ramularia primulae,* not previously observed in the writer's experience on this host though common on outdoor primulas. All varieties suffered equally, and practically every leaf bore rapidly spreading, irregular, brown blotches covered on both surfaces with the pale grey to purple mycelium of the fungus. Successful control of *Gloeosporium limetticolum* [? *Colletotrichum gloeosporioides*] on valuable old citrus trees was achieved by drastic pruning, removal and destruction of diseased material, and preventive treatments of the sound wood and foliage with Wacker's Kupferkalk [ibid., xvi, p. 230] with the addition of tezet [ibid., xv, p. 580] as a spreader.

K. (H.). **Ueber Krankheiten in Baumschulpflanzungen, die durch Bodenverhältnisse verursacht werden.** [On diseases in tree nursery plantings caused by soil conditions.]—*Blumen- u. PflBau ver. Gartenwelt,* xli, 37, p. 431, 1937.

A planting of roses grafted on *Rosa rubiginosa* and *R. canina* suddenly developed a disease characterized by blackish spots, about 3 cm. in length, girdling the stems from the site of insertion of the buds downwards. At first infection was restricted to the cambial layers, but before the buds opened it had completely permeated the tissues so that the stems wilted and the buds collapsed. The fungus responsible for the disease was identified at the Geisenheim [Rhine] Phytopathological Experiment Station as *Diplodia rosarum* [*R.A.M.*, xiii, p. 9], a comparatively rare pathogen occurring only on plants in poor soils. In the case under observation the infection passed in the form of transverse bands through the field, sparing the bushes on the high ground at either end. Notes on the malnutrition of other plants are also given.

Ogilvie (L.). **Some experiments with Lilies.**—*Lily Yearb. R. hort. Soc.*, vi, pp. 106–108, 1937.

Cylindrocarpon radicicola has been reported to cause a root and bulb rot of lilies in Holland [*R.A.M.*, xi, p. 243], but in experimental inoculations on 14 plants at the Long Ashton Research Station, Bristol, with four strains of the fungus isolated from *Lilium longiflorum* and *L. duchartrei* no infection resulted. Most of the rotting of the roots of lilies is thought probably to be due to waterlogging and other adverse soil conditions.

Schneiders (E.). **Über Abbau und Viruskrankheiten der Kulturpflanzen unter besonderer Berücksichtigung der Viruskrankheiten an Dahlien.** [On degeneration and virus diseases of cultivated plants with special reference to the virus diseases of Dahlias.]—*Gartenflora,* lxxxvi, 9, pp. 199–202, 2 figs., 1937.

Following a general review of the nature, etiology, and symptoms of degeneration and virus diseases of cultivated plants, the writer discusses the virus disorders of dahlias occurring in Germany, viz., stunt [*R.A.M.*, xiii, p. 99], mosaic [ibid., xiv, p. 634], ring spot [ibid., xiii, p. 492], spotted wilt [ibid., xv, p. 444; xvi, p. 285], and (?) streak [ibid., xiii, p. 516].

Stunt belongs to a group of degeneration and virus diseases, which comprises such disorders as arise only as a reaction to unfavourable environmental factors. Transverse sections of 150 μ in thickness through the basal shoots contain at least one intracellular cordon [ibid., xvi, p. 622], while phloem necroses are also typical. The leaves of the stunted axes (rosette formation) are abnormally dentate and largely asymmetrical; the glassy aspect of the veins and their prominent mottling are plainly apparent in transmitted light. Severely diseased plants do not flower. Other features of stunt in fairly vigorous plants include the development of internodes of irregular length and structural changes in the shoot axis.

Mosaic, ring spot, and spotted wilt represent purely infectious diseases, in which the action of the pathogenic agent is expressed in chlorophyll defects and abnormalities in leaf shape. Intracellular cordons are not characteristic of these disturbances. Owing to the paucity of material it has so far been impossible definitely to identify the greyish-brown, necrotic streaks on the petioles as manifestations of streak disease.

Brief, practical indications are given for the control of diseases of the foregoing types.

LEWIS (ESTHER A.). **Some fungous diseases of Clarkia elegans.**—*Phytopathology*, xxvii, 9, pp. 951–953, 1937.

In a perusal of the relevant literature the writer found only two records of fungi on *Clarkia elegans*, i.e., *Vermicularia clarkiae* Fautr. on the leaves and *Cytosporella clarkiae* Oud. on the stems, both from Europe [but see *R.A.M.*, xiv, p. 678]. *Puccinia clarkiae* Peck and *Synchytrium fulgens* [ibid., xv, p. 524] were found on herbarium material from California, where the plant occurs as a native annual. The following fungi (in addition to five apparently non-pathogenic species) were found on diseased plants and inoculated into healthy seedlings with positive results: *Alternaria tenuis*, *Botrytis cinerea*, *Citromyces griseus*, *Cladosporium elegans*, *Fusarium* sp., *Helminthosporium* sp., *Hormodendrum cladosporioides* [see above, p. 84], *Oospora epilobii* (Cda) Sacc. & Vogl., *Penicillium* [*Scopulariopsis*] *brevicaule*, *Peronospora arthuri* Farl., *Pleospora herbarum*, *Pythium de Baryanum*, and *Verticillium albo-atrum*.

BECKER. **Schon im Herbst Kleekrebs-Bekämpfung.** [Begin with Clover rot control in the autumn.]—*Dtsch. landw. Pr.*, lxiv, 36, p. 437, 1937.

Clover rot [*Sclerotinia trifoliorum*: *R.A.M.*, xvi, p. 754] is stated to be widespread in the Eutin district [Oldenburg], where it chiefly affects the red and crimson varieties [*Trifolium pratense* and *T. incarnatum*] and lady's finger [*Anthyllis vulneraria*], though yellow and alsike [*T. agrarium* and *T. hybridum*] are also susceptible, while white clover

[*T. repens*] is resistant. In the very snowy winter of 1928–9 the fungus was present in all the 83 clover stands inspected, causing losses ranging from 20 to 80 per cent. in about half the number. One of the best means of combating the disease is to keep the stands well grazed, tall, straggling plants being much more liable to attack. *S. trifoliorum* predominates in light soils, where the plants cannot easily take root; rooting may, however, be assisted by rolling in the spring and autumn and by sowing clover among winter instead of summer cereals, barley being particularly favourable for this purpose.

HENSON (L.) & VALLEAU (W. D.). **Sclerotium bataticola Taubenhaus, a common pathogen of Red Clover roots in Kentucky.**—*Phytopathology*, xxvii, 9, pp. 913–918, 2 figs., 1937.

An account is given of the writers' studies on the fungus responsible for red clover [*Trifolium pratense*] root blackening in Kentucky, with special reference to their reasons for retaining the name *Sclerotium bataticola* [*R.A.M.*, i, p. 36; iii, p. 248; iv, p. 350; v, p. 451; vi, p. 757] for the organism in preference to *Rhizoctonia bataticola* (of which *Macrophomina phaseoli* is a pycnidial strain) [ibid., xvi, p. 658].

In pure culture all the strains of the fungus isolated from clover plants of different varieties, two months to two years old, produced hyaline, profusely branched hyphae without clamp-connexions and formed sclerotia in 36 hours to three days, according to the type of mycelial growth; these organs are smooth, black, spherical, oblong, oval, or curved, and measure 61 to 150 μ on dead clover crowns, 57 to 145 μ on pepper [*Capsicum*] fruits, and 70 to 242 μ on 2 per cent. potato dextrose agar. No pycnidia were observed on any of the media used. Potato dextrose agar and potato plugs are often coloured vinaceous to mineral red (Ridgway). Cultures of *S. bataticola* from California and North Carolina were morphologically indistinguishable from the Kentucky clover material. The fungus was mildly pathogenic to red clover in soil inoculation experiments in the greenhouse.

After briefly summarizing the literature on the taxonomy of *M. phaseoli*, the writers point out that the clover fungus presents closer affinities with the Ascomycetes than with the Basidiomycetes. There is no evidence of clamp-connexion formation, and the type of branching on which it was presumably first identified as a *Rhizoctonia* (inception at right angles to the parent hyphae, constriction at the site of origin) is not a reliable character for the separation of Basidiomycetes from Ascomycetes. Ample proof seems to be forthcoming that *S. bataticola* sometimes produces pycnidia of the common Ascomycete type, whereas these organs are extremely rare, if not altogether lacking, in the true Basidiomycetes. In view of these considerations the use of the name *S. bataticola* instead of *R. bataticola* for the sclerotial strains of *M. phaseoli* is advocated.

Lupinenwelke und ihre Bekämpfung. [Lupin wilt and its control.]—*Dtsch. landw. Pr.*, lxiv, 38, p. 463, 1937.

Considerable difficulty is presented by the problem of combating the fungal wilt of lupins [associated primarily with *Thielaviopsis basicola*: *R.A.M.*, xvi, p. 539], which is causing steadily increasing losses in this

important German fodder crop. In the Potsdam district the disease occurs on light soils of superior constitution bearing lupins for the first time, so that the existence of alternate hosts of the fungus is obvious. Yellow lupins [*Lupinus luteus*] suffer most severely from the wilt, but the blue [*L. angustifolius*] are also liable to infection. Weather conditions, time of sowing, and age of the plants appear to play no decisive part in the development of *T. basicola* on lupins, and seed treatment offers little hope of success owing to the persistence of the organism in the soil. Varietal selection trials have been planned by the local plant protection authorities in co-operation with the Biological Institute.

Cormack (M. W.). **Cylindrocarpon ehrenbergi Wr., and other species, as root parasites of Alfalfa and Sweet Clover in Alberta.**—*Canad. J. Res.*, xv, 9, pp. 403–424, 1 pl., 2 figs., 1 graph, 1937.

The results of continued investigations of the root rot of lucerne and sweet clover [*Melilotus* spp.] in Alberta showed that, apart from *Plenodomus meliloti* and *Sclerotinia* sp. [*R.A.M.*, xv, p. 445], *Cylindrocarpon ehrenbergi* Wr. [ibid., xvi, p. 298] is probably one of the most important parasites associated with the condition. This fungus was isolated from a large proportion of the diseased roots collected from widely separated points throughout the province, both in virgin and cultivated soils. In artificially inoculated soil it was shown to begin invading the uninjured host roots at the earliest sign of thawing in the soil, either directly through the unwounded cortex or through the lenticels or the basal tissues of the lateral roots. The lesions on the roots at first have a watersoaked appearance; they soon increase in size and finally turn dark brown; in severe cases the entire root system decays within a week or two from the first sign of infection. Another type of injury frequently caused by *C. ehrenbergi* in the early spring is crown rot, the plants dying when the crown buds are destroyed. Sweet clovers usually suffer more than lucerne from the attacks of the fungus, but the degree of infection varies greatly from year to year. Natural infection of the roots of both crops was rarely observed during the growing season, and infection from artificial inoculations of the roots was much less severe later in the season than in the early spring.

Studies of 35 isolates of *C. ehrenbergi* showed that they differed in their pathogenicity to sweet clover and lucerne, and gave indications of host specialization; they also differed markedly in morphological and cultural characteristics which, however, did not appear to be correlated with parasitism. In pure culture *C. ehrenbergi* grew at temperatures ranging from —2° to 32° C., the optimum varying, however, from one isolate to another. Isolates with an optimum at about 19° caused the most damage in the early spring, while a strain growing best at 24° proved to be the most virulent during summer. While the optimum hydrogen ion concentration for growth varied with the medium employed, growth and spore germination studies indicated that the isoelectric point for the fungus lies at approximately P_H 5·1. *C. ehrenbergi* was also shown to be pathogenic to roots of *Trifolium* spp.

Isolations from diseased lucerne roots occasionally also yielded *C. obtusisporum* [ibid., xvi, p. 822], *C. olidum* [ibid., xv, p. 605], and *C. radicicola* [ibid., xvi, p. 813]: the last-named was also obtained from

sweet clover roots, and the first-named from diseased raspberry roots. It was experimentally shown that *C. obtusisporum* is slightly to moderately pathogenic, *C. radicicola* is very weakly so, and *C. olidum* is not pathogenic. No species of *Cylindrocarpon* was isolated from the seeds of lucerne and sweet clover.

Further experiments showed that most of the commonly grown varieties of lucerne and sweet clover are susceptible to attack by *C. ehrenbergi*, but resistant species like *Medicago falcata* may prove valuable for breeding resistant forms. It is suggested that severely infected lucerne and sweet clover fields should be cropped for several years with cereals, which apparently are not attacked by *C. ehrenbergi*.

Bratley (C. O.). **Incidence and development of Apple scab on fruit during the late summer and while in storage.**—*Tech. Bull. U.S. Dep. Agric.* 563, 45 pp., 11 figs., 4 graphs, 1937.

This detailed study on the development of *Venturia inaequalis* on stored apples [*R.A.M.*, xiv, p. 111; xvi, p. 263, *et passim*] and in the orchard was made on account of disputes arising between storage managers and owners of fruit in the United States regarding the responsibility for scab development in storage. Cultural experiments showed that the fungus can grow at 32° F., the usual storage temperature. In early summer lesions and fruit enlarge *pari passu* but in late summer the enlargement of the lesions proceeds much more rapidly than that of the fruit. In commercial storage only a small percentage of old lesions enlarge, and the usual increase in diameter amounts to only 1 or 2 mm. The number of new lesions appearing during storage varies greatly with the season and place of origin and may be commercially important. The greatest enlargement of lesions occurs on fruit packed while wet in tight boxes, but in other respects the type of storage container has little effect on the development of the disease; in open containers the lesions often decrease in size. The source of the fruit has much more effect on the development of lesions in storage than have slight variations in orchard practice. When relative humidity in storage is constant, greater enlargement of lesions occurs at 40° than 32°, but at a constant storage temperature increase in relative humidity promotes greater enlargement of the lesions. Lesions may appear at any time during storage, in some cases becoming visible after the normal storage life. When scabby and clean fruit from the same tree are stored together the number of lesions appearing on the former is increased. In natural infections more new lesions appear on the stem half of the fruit than elsewhere, but inoculation experiments failed to demonstrate any difference in susceptibility between the stem and blossom-end halves, or between blush and green areas. No macroscopic differences were noted that indicated which lesions would subsequently enlarge during storage; if a strip of dark fungus remains at the edge, even lesions well corked-off may enlarge. In general, there was no difference in appearance between lesions that had enlarged during storage and those that had not; the mycelium in both was much darker than in orchard lesions. When fruit was held at temperatures above 40° or for a long period at 32° the fungus ramified rapidly through the surface flesh without visibly affecting the cuticle. Lesions

appearing on McIntosh fruit during storage are often quite similar to orchard lesions, but are usually darker, while on very ripe fruits they are jet-black and do not break the cuticle. Similar lesions were found on Baldwin fruits.

Apples were successfully inoculated throughout their development on the tree and even after picking, but in no instance were inoculations of mature apples successful when followed immediately by storage. All attempts to obtain spread of infection from affected to clean fruit were unsuccessful. Infections developing during storage would appear to have originally occurred on the tree.

Apples inoculated in the middle of August and submitted to moist conditions for 28 hours did not become infected, whereas those exposed for 40 hours developed numerous lesions. Increasingly long wet periods become necessary for infection as the fruit develops. The shortest and longest periods of latency on inoculated fruits were 23 days and $6\frac{1}{2}$ months, respectively. In each of three years the latest natural inoculations occurred about the middle of August; some of the resultant infection appeared in storage.

KEITT (G. W.) & PALMITER (D. H.). **Potentialities of eradicant fungicides for combating Apple scab and some other plant diseases.**—*J. agric. Res.*, lv, 6, pp. 397–437, 2 figs., 4 graphs, 1 plan, 1937.

This is a full report of the results obtained so far in the work which has been prosecuted since 1924 in Wisconsin for the purpose of testing the possibility of controlling apple scab (*Venturia inaequalis*) by chemical methods aiming at the immunization of the host or the eradication of the parasite [see below, p. 121]. The more important of these results have already been noticed in this *Review* from an abstract in another publication [*R.A.M.*, xvi, p. 470].

An account is further given of small-scale exploratory tests on the potentialities of copper-lime-arsenic mixtures for the suppression of primary inocula in relation to eight other plant-pathogenic fungi, most of the results of which have also been already noticed from another source [ibid., xv, p. 2]. It is also stated that dormant spraying with some of the mixtures was also highly effective against the sclerotia, mycelia, and basidiospores of *Corticium koleroga* causing thread blight of the fig (*Ficus carica*), and partly effective in suppressing the production of pycnospores of *Phyllosticta solitaria* on apple, and of conidia of *Cladosporium carpophilum* on peach. It is stressed, however, that the studies have not yet reached a stage warranting large-scale trials of any of the methods discussed in this paper.

There was clear evidence that the toxicity of the copper-lime-arsenic mixtures to both host and parasite can be varied through a wide range by the choice of the arsenical component, modifications in the amounts and proportions of the ingredients, and the use of amendments. It was shown that the preparations liberate soluble materials capable of diffusing through acid, neutral, or alkaline media, and of exercising fungicidal action at considerable distances from the undissolved residues. Suitable mixtures are highly effective against the fruiting bodies of the fungi, which develop at the surface, or close to the permeable surface of invaded tissues, a fact which renders many of the plant pathogenic

organisms vulnerable to attack by surface applications of eradicant fungicides.

BURKHOLDER (C. L.). **Spray injury and fruit russet.**—*Hoosier Hort.*, xix, 9, pp. 134–139, 1937.

Sulphur sprays, applied to apple trees in the pre-blossom stage shortly after a dormant treatment with oil, for scab [*Venturia inaequalis*] control, may cause very severe injury under Indiana conditions. According to F. Beach, of Ohio University, this type of damage may be greatly reduced or eliminated by the addition of 2–6–100 Bordeaux to the dormant oil spray mix, which should be given as long as possible before the first scab treatment.

Lime-sulphur burn [*R.A.M.*, xvi, p. 189, *et passim*] falls into two categories, associated with (1) slow drying in damp weather, and (2) high temperatures. In the case of (1) the adverse effects of the treatment may be minimized during the pre-blossom period by reducing the liquid lime-sulphur to 2 or 3 qts. per 100 gals. and adding 4 to 6 lb. wettable sulphur, while in that of (2) the substitution of wettable sulphur for liquid lime-sulphur from the calyx spray onwards is recommended.

Bordeaux mixture is very effective against scab when applied during blossoming [ibid., xvi, p. 188], at which stage it is also less liable to cause russeting under humid conditions than later. The Jonathan and Ben Davis varieties are very liable to russeting through unfavourable weather conditions early in the season, while Rome is resistant both to weather and spray injury. Golden Delicious is very difficult to produce with a good finish, and should be treated with wettable sulphur from the petal-fall spray onwards, while Stayman and Grimes are also very susceptible to foliage and fruit injury.

WOODBRIDGE (C. G.). **The boron content of Apple tissues as related to drought spot and corky core.**—*Sci. Agric.*, xviii, 1, pp. 41–48, 1937.

A tabulated summary is given of experiments carried out in British Columbia, the results of which established the existence of a definite correlation between low boron content in apple tree tissues (one-year-old twigs, mature leaves, and mature fruits) and a high incidence of drought spot and corky core [*R.A.M.*, xvi, p. 819], and also showed a correlation between high boron content and absence of disease. The twigs of entire healthy trees contained at least 14 p.p.m. boron, while those from diseased trees contained less than 10 p.p.m. Some disease may be expected in trees with a boron content between these two figures.

Analyses of soil taken at depths varying from 12 to 24 in. at distances of approximately 6 ft. from the trees gave a definite correlation between high boron content and absence of disease, but where the boron content of the soil was low, as was found around all the control trees receiving no applications of boron, some of the trees being healthy and some diseased, no correlation existed. It is possible, however, that the method used in making soil extractions did not bring into solution all the boron available to the trees, or another explanation may be that trees which had suffered from heavy rootlet injury had been weakened in their ability to assimilate boron from the soil.

Rives (L.). **Sur l'apoplexie du Prunier de Burbank et de l'Abricotier.** [Note on the apoplexy of the Burbank Plum and of the Apricot.] —*Progr. agric. vitic.*, cviii, 32, pp. 125–128, 2 figs., 1937.

The author states that isolations from the diseased tissues of the Burbank plum presenting symptoms of apoplexy as described by him in a previous communication [*R.A.M.*, x, p. 529], yielded yellow and white strains of bacteria, the identity of which is still under investigation. Inoculations in September, 1932, into one-year-old Burbank plums, grafted on myrobalan [*Prunus divaricata*] stocks, either with the yellow organism alone or with a mixture of the two strains, reproduced the condition, and led to the death of all the inoculated trees in September, 1934. Apricots similarly inoculated remained healthy. The suspected identity of the yellow strain with *Bacillus amylovorus* [*Erwinia amylovora*] has not been substantiated.

McWhorter (O. T.). **Peach twig blight active in Oregon.**—*Bett. Fruit*, xxxii, 2, p. 10, 1937.

Peach twig blight and fruit spot [*Clasterosporium carpophilum*] has been a serious disease in Oregon since 1906, production being frequently impossible in the Willamette Valley unless spraying is carried out annually; it is also destructive in eastern Oregon. Apricots are also severely affected, part of the 1937 crop being unmarketable as a result of infection, which occurs in other north-western states besides Oregon.

Control consists in spraying with Bordeaux mixture 4–4–50 in early autumn before the rains start, the spray being carefully applied to the new growth, including the smallest bud and twig. Later applications serve only to check spread. Peaches may sometimes require a spring application of wettable sulphur at petal-fall to prevent fruit spot following twig blight.

Osterwalder (A.). **Eine wirksame Bekämpfung der Quittenkrankheit.** [An effective control of the Quince disease.]—*Schweiz. Z. Obst- u. Weinb.*, xlvi, 14, pp. 234–238, 2 figs., 1937.

Good control of *Sclerotinia cydoniae* on quinces [*R.A.M.*, xii, p. 488] in Switzerland was obtained in recent experiments by two to three applications of Bordeaux mixture during the blossom.

Galang (F. G.) & Lazo (F. D.). **The setting of Carabao Mango fruits as affected by certain sprays.**—*Philipp. J. Agric.*, viii, 2, pp. 187–210, 2 figs., 3 graphs, 1937.

Studies carried out in the Philippine Islands on the effects of certain sprays on the setting of Carabao mango fruits showed that in 1934–5 the plants sprayed with fungi-bordo gave 0·00947 per cent. setting, while in the following season the figure was 0·11933 per cent., the settings in the unsprayed controls being 0·02745 and 0·20348 per cent., respectively. The best settings were given by lime-sulphur (7 spoonfuls to 5 gals. of water) with 0·06389 per cent. setting in the 1934–5 experiment and 0·15674 (control 0·08378) per cent. setting in 1935–6. Spraying with rain- or tap water reduced setting as compared with the unsprayed controls.

WAGER (V. A.). **Mango diseases in South Africa.**—Reprinted from *Fmg S. Afr.*, xii, 4 pp., 7 figs., 1937.

In these notes on the symptoms and control of the principal diseases of mangoes in South Africa it is stated that bacterial black spot (*Bacillus mangiferae*) [*Erwinia mangifera*: *R.A.M.*, xiii, p. 174] usually becomes noticeable in the Transvaal after the first November rains, spreading rapidly if an appreciable amount of rain falls during the next two months. In dry seasons the disease causes little damage. Losses may be materially reduced by four to seven very thorough applications of Bordeaux mixture used at standard strength with a spreader added and given as soon as the lesions appear, and afterwards once a fortnight during dry weather, and immediately after every rainstorm until the middle of January. On some large trees spraying has increased the yield of clean fruits, as compared with the unsprayed controls, by 80 per cent. The control of anthracnose or ripe rot (*Colletotrichum gloeosporioides*) [ibid., vi, p. 288] also depends on orchard applications of Bordeaux mixture, treatments of picked fruit having practically no effect, as the fungus apparently enters the pores of the fruit while it is still green, and develops in the flesh during ripening. The discoloration due to sooty blotch (*Gloeodes pomigena*) [ibid., xiv, p. 426] reduces the commercial value of the fruit, which should be dipped for two minutes in a bleaching solution of $\frac{1}{4}$ lb. each of chloride of lime and boracic acid per gal. of water [cf. ibid., xiv, p. 754], afterwards being washed in clean water and stacked to dry. The disease is unlikely to appear in sprayed orchards. Mildew (*Erysiphe cichoracearum*) [ibid., xiv, p. 426] has in recent years become widespread and patchy in the Eastern Transvaal. Some trees may set no fruit as a result of infection, while others in close proximity may bear a good crop. A hot, dry spring with heavy dews nightly conduces to severe outbreaks; in two experiments sulphur dusting [ibid., x, p. 326] gave rather inconclusive results. If the blossoms are seriously attacked spraying with Bordeaux mixture should be begun at the peak of the flowering period and repeated a fortnight later.

PALMITER (D. H.) & KEITT (G. W.). **The toxicity of copper-lime-arsenic mixtures to certain phytopathogenic fungi grown on malt agar plates.**—*J. agric. Res.*, lv, 6, pp. 439–451, 3 figs., 1 graph, 1937.

In addition to the information contained in the preliminary account of this work, which has been noticed from another source [*R.A.M.*, xiv, p. 381], it is stated that the toxicity of the copper-lime-arsenic mixtures studied, and of their separate ingredients, was tested on the following plant-pathogenic fungi, namely, *Venturia inaequalis*, *V. pirina*, *Cladosporium carpophilum*, *Phyllosticta solitaria*, *Elsinoe veneta*, *Glomerella cingulata*, *Physalospora obtusa*, and *Sclerotinia fructicola*, all of which proved to be highly susceptible to the action of suitable mixtures [see above, p. 118]. Monocalcium arsenite was the most toxic of the arsenical compounds tested, usually three to more than ten times as toxic as copper sulphate, depending on the fungus used. Tricalcium arsenite was slightly less toxic than monocalcium arsenite, and zinc and iron arsenite were of comparatively low toxicity, while Paris green and

copper arsenite were intermediate. Tricalcium arsenate was the least toxic of all, and dicalcium arsenate showed but slightly higher toxicity.

MacLeod (G. F.) & Sherwood (H. F.). **Grenz radiographs of sulfur dispersion on foliage.**—*J. econ. Ent.*, xxx, 3, pp. 395–399, 2 figs., 1 diag., 1937.

The need for a rapid and accurate method of depicting sulphur residues on foliage led to preliminary tests with Grenz-ray radiography at the Eastman Kodak Research Laboratories, Rochester, New York. Baldwin apple leaves were sprayed in the laboratory with mixtures of 14 gm. 325-mesh unconditioned pure sulphur in solutions of (1) 2 gm. 13 per cent. soap water, (2) 2 gm. areskap dry 100 [*R.A.M.*, xvi, p. 196], and (3) 2 c.c. mouillant M (an alkyl-aromatic sulphate), as wetting agents in 1,000 c.c. distilled water. After six hours' drying one half of the sprayed surface was coated with a waterproof lacquer which dried in half an hour and the leaves were then completely submerged for 30 seconds in a bath of distilled water. After this 'artificial weathering' the leaves were again dried and coated with lacquer to preserve any spray material surviving the 'weathering' and photographed by Grenz (soft X-ray) radiation. By these means it was shown that larger amounts of sulphur are retained both on the upper and lower surfaces of leaves sprayed until they dripped than on those sprayed until one drop formed. Heavier initial deposits also resulted in a higher degree of resistance to 'weathering'. In all cases the lower surfaces retained more sulphur than the upper ones. Mouillant M deposited the largest amounts of sulphur on the under sides of the leaves and soap the smallest, much of which was also lost through 'weathering'.

Yarwood (C. E.). **Sulphur and rosin as downy mildew fungicides.**—*Phytopathology*, xxvii, 9, pp. 931–941, 1 fig., 1 diag., 1937.

In order to test the toxicity of sulphur dust (flottox) to the sporangia of onion downy mildew (*Peronospora destructor*) [*P. schleideniana*: *R.A.M.*, xvi, p. 651], these organs were added in the form of a suspension to glass slides and as an atomized spray to plates of agar, both dusted with the fungicide. The preparations were incubated in the dark at 10° C. in one test, at 19° in another, and at 22° in two further trials. After 24 hours germination in four tests on the sulphur-dusted slides was 75, 78, 69, and 83 per cent., respectively, the corresponding figures for untreated control slides being 95, 93, 64, and 86 per cent., respectively; there was no germination on the dusted agar plates, and 91, 92, 51, and 84 per cent., respectively, on the controls. In another test, small heaps of sulphur dust and drops of a water suspension of it were applied to localized areas on plates of cold agar prior to dusting with the mildew sporangia, no germination of which occurred for a distance of 1·3 mm. from the edge of the sulphur.

The toxicity of lime-sulphur, copper sulphate, and rosin [ibid., viii, p. 655] solutions was tested by adding sporangial suspensions to solutions of known strength and placing drops of this suspension on glass slides or atomizing them on plates of agar. The minimum concentrations at which spore germination was inhibited were 1 in 10,000 for lime-sulphur on slides and agar plates, 1 in 100,000 for copper sulphate

on both, 1 in 10,000 for rosin on slides, and 1 in 1,000 for the same on agar plates. These results indicate that sulphur dust, lime-sulphur, and rosin are all moderately toxic to the sporangia of *P. schleideniana*, but not in the same degree as copper sulphate, their efficacy being furthermore largely dependent on the substratum.

The distribution of Bordeaux and lime-sulphur sprays without spreaders is poor on onion foliage; by the addition of penetrol [ibid., xvi, p. 797] to the former and sodium oleyl sulphate [ibid., xv, p. 781] to the latter in appropriate quantities the covering properties of the sprays were enhanced, the amount of fungicide deposited on the leaf surface substantially reduced, and the protective action increased. On hop and bean [*Phaseolus vulgaris*] leaves, which are much less difficult to wet than those of onions, the initial spray deposit was heavier and the effect of the spreaders correspondingly less noticeable.

In greenhouse and field tests 1 per cent. Bordeaux+0·05 per cent. penetrol, 2 per cent. lime-sulphur+0·05 per cent. sodium oleyl sulphate, and rosin alone or with lime-sulphur in varying proportions, gave satisfactory control of *Peronospora schleideniana* on Prizetaker onions and also of hop downy mildew [*Pseudoperonospora humuli*: ibid., xvi, p. 836]. Onions sprayed with rosin-lime-sulphur and exposed to known amounts of rain before inoculation with the downy mildew fungus generally resisted infection, whereas Bordeaux mixture, rosin alone, or lime-sulphur alone failed to exert a comparable protective action. Onions for seed yielded more abundantly and showed less infection when treated with lime-sulphur than when sprayed with Bordeaux or rosin; in the case of plants for greens the best results were obtained with rosin-lime-sulphur.

Lime-sulphur (2 per cent.)+0·05 per cent. sodium oleyl sulphate or 1 per cent. rosin effectually prevented the over-night sporulation of *P. humuli* and *Peronospora schleideniana*, the rosin combination being particularly successful, whereas Bordeaux, sulphur dust, and rosin alone failed in this respect. Judging by the outcome of these experiments as a whole, rosin-lime-sulphur was the most efficacious of the fungicides tested both from the standpoint of protection against disease and weathering and from that of increased yield.

Camenzind (P.). **Neuer Erdsterilisierapparat.** [A new soil sterilization apparatus.]—*Blumen- u. PflBau ver. Gartenwelt*, xli, 37, p. 428, 1 fig., 1937.

A note is given on the construction of the 'Pronto' soil sterilization apparatus [cf. *R.A.M.*, xvii, p. 51], which is stated to have been used with excellent results in Switzerland. It consists of a soil container of 25, 40, or 60 l. capacity, into which the steam is introduced from all sides so that the soil reaches the necessary temperature of 95° to 100° C. in 7 to 15 minutes.

Shewell-Cooper (W. E.). **A simple yet effective soil steriliser.**—*Parks, Golf Courses & Spts Grnds*, ii, 12, pp. 334–336, 4 figs., 1 diag., 1937.

Details are given of the construction of the Reaseheath sterilizer, consisting of a long shallow trough of brickwork (23 ft. by 3 ft. 1½ in.

by 1 ft. 2 in. deep) capable of holding several tons of soil built over four flues divided by thin vertical walls, with a fire-box at one end and chimney at the other, a rise of 9 in. being made in the trough towards the chimney end. Using coke as fuel the temperature of the soil is raised to an average of 205° to 210° F. in eight hours, thick sacking being used to cover the soil to conserve the heat. After baking for four hours the soil is double dug and heated for four hours more.

KIENHOLZ (J[ESS] R.). **Isolating single spores without special equipment.**—*Phytopathology*, xxvii, 9, pp. 950–951, 1 fig., 1937.

Details are given of a simple method of isolating single spores, the only special instrument required being a glass transferring rod, heated in a flame and drawn out to a hair, at the extremity of which a small knob is produced by light contact with the base of the flame, the total length of the rod being 3 to 4 in. Transfers from a spore suspension on a slide to marked areas of agar plates are made by means of the knob.

CHESTER (K. S.). **A critique of plant serology. Part II. Application of serology to the classification of plants and the identification of plant products. Part III. Phytoserology in medicine, and general biology. Bibliography.**—*Quart. Rev. Biol.*, xii, 2, pp. 165–190; 3, pp. 294–321, 1937.

This is the continuation and conclusion of the writer's critical studies on recent developments in plant serology, the opening section of which has already been noticed [*R.A.M.*, xvi, p. 698]. The following are the headings under which the subject is discussed in these two instalments: identification of plant products, application to plant systematics, serology of purified or altered plant proteins, serology of plant non-proteins, certain medical aspects of plant serology, application of phytoserology in the study of certain basic biological problems (movement of proteins in plants, investigation of hybrids, contributions to the plant virus problems), and the possibilities and limitations of phytoserology. The supplementary bibliography comprises 392 titles.

Yearbook of Agriculture, 1937.—1497 pp., 327 figs., 1 graph, 17 maps, Washington, D.C., United States Department of Agriculture, 1937. Price $2.

This yearbook is complementary to the volume published in 1936 [cf. *R.A.M.*, xvi, pp. 62, 82] and, with it, aims at presenting, in a series of papers by specialists, a national and, to some extent, an international survey of practical breeding work and genetic research with plants important to American farming. The present work covers an enormous field, dealing as it does with garden vegetables, northern tree and bush fruits, sub-tropical fruits, flowers, nut trees, forest trees, and forage grasses and legumes, as well as animals, bees, and poultry. Disease resistance figures largely as an aim in American breeding work, and is discussed in some detail in the various sections, which are supplemented with basic data and tables including, *inter alia*, lists of plants with superior germ-plasm for various characteristics available for breeding work. Recent achievements in this field include the wilt [*Fusarium bulbigenum* var. *lycopersici*] -resistant Marglobe tomato variety [ibid.,

xvi, p. 782], which saved the Florida growers from ruin, cantaloupe strains resistant to powdery mildew [*Erysiphe cichoracearum*: ibid., x, p. 431], strains of lettuce and snap beans [*Phaseolus vulgaris*] resistant to several of the chief diseases affecting these crops, and cabbages resistant to yellows [*Fusarium conglutinans*: ibid., xvi, p. 159].

Some aspects of the plant disease eradication and control work of the Bureau of Entomology and Plant Quarantine.—*Plant Dis. Reptr, Suppl.* 99, pp. 17–46, 1937. [Mimeographed.]

Notes are given on the progress made in the United States during 1936 in the eradication campaigns against various diseases.

O. N. Liming states that in the Dutch elm disease [*Ceratostomella ulmi*: *R.A.M.*, xvi, pp. 645, 782] centres outside the major area of infection [cf. ibid., xv, p. 692] not one tree became affected, and the number of diseased trees in eight localities in New York state and New Jersey amounted to 127, as against 477 in 1935 and 1,115 in 1934.

S. B. Fracker states that about 196,211,187 *Ribes* bushes over an area of 3,829,890 acres were eradicated during 1936 in the course of the campaign against *Cronartium ribicola* [see below, p. 143]. The disease caused great damage to *Pinus lambertiana* in the vicinity of Panther Mountain, Oregon [ibid., xvi, p. 74], where it appears to have been present for 10 years; the trees showed practically 100 per cent. infection, pines up to 8 in. in diameter and 70 years of age succumbing. About 21 per cent. of the area has already been subjected to eradication methods. In 1936, 85,385 cultivated black currant bushes were destroyed in the Lake States.

During the same period over 68,500,000 *Berberis* bushes were destroyed in the campaign against wheat stem rust (*Puccinia graminis*). Among the new chemicals tested for eradication purposes atlacide applied as a spray and as a soil drench at the rate of 8 lb. in 5 gals. of water to each square rod was very effective.

According to B. M. Gaddis over 21,000,000 peach trees were inspected for phony disease [ibid., xvi, p. 329] in 20 States during 1936, 156,977 diseased trees being found and 146,072 removed. All infected trees will probably have been removed from all States except Georgia by the end of 1936. The disease was found for the first time in Indiana and Pennsylvania.

In the campaign against *Bacterium* [*Pseudomonas*] *citri* over 13,600,000 citrus trees were eradicated between 1st July, 1935 and 31st December, 1936 [ibid., xvi, p. 192].

Atanasoff (D.). **Virus diseases of plants: a bibliography. I. Supplement.**—*Phytopath. Z.*, x, 4, pp. 339–463, 1937.

This first supplement to the writer's bibliography of the virus diseases of plants [*R.A.M.*, xiii, p. 530] comprises a large number of further titles of papers issued since that date, arranged under 49 headings with the addition of author and general indexes.

Chester (K. S.). **Serological studies of plant viruses.**—*Phytopathology*, xxvii, 9, pp. 903–912, 1937.

Recent precipitin tests [*R.A.M.*, xvi, p. 767] indicate that Canada

streak of potato is a strain of aucuba mosaic of potato; Blakeslee's Z-mosaic of *Datura* is a strain of the etch group [loc. cit.]; Price's cucumber mosaic isolates are strains of the cucumber mosaic group [ibid., xvi, p. 615], though celery mosaic [ibid., xvi, p. 584], lily mosaic [ibid., xvi, p. 752], and Doolittle's cucumber mosaic juices failed to react with sera for Price's cucumber mosaic; the European Y-virus of potato [ibid., xvi, p. 771] is serologically indistinguishable from the American potato veinbanding virus [ibid., xvi, p. 828], to which stipplestreak [ibid., xvi, pp. 481, 631] is also related; the latter, being ordinarily associated in the field with latent mosaic [ibid., xvi, p. 630], is considered to be a type of rugose mosaic [ibid., xvi, pp. 116, 337, 489].

Tobacco mosaic virus, propagated in root-tissue cultures and locally necrotic lesions, yields specific virus antigen. All the viruses that have so far proved serologically active are placed in the following eight groups according to their relationship reactions: (*a*) tobacco mosaic, (*b*) potato latent mosaic, (*c*) potato veinbanding, (*d*) potato aucuba mosaic, (*e*) etch, (*f*) tobacco ring spot, (*g*) pea mosaic viruses 2 and 3 [see above, p. 90], and (*h*) potato mild mosaic [ibid., xv, p. 459; xvi, pp. 480, 487]. Among the 19 viruses (besides those mentioned above) failing to give serological responses may be mentioned aster [*Callistephus chinensis*] yellows, peach yellows, potato witches' broom, potato leaf roll, potato mild circular mottle, potato yellow dwarf, potato calico mosaic, potato spindle tuber, potato crinkle mosaic (crinkle of Schultz and Folsom), pea mosaic virus 1, bean [*Phaseolus vulgaris*] mosaic, sugar-cane mosaic, sugar beet mosaic, tomato spotted wilt, and crucifer mosaic. Such viruses, in contrast to the serologically positive group, are difficult or impossible to transmit mechanically, relatively unstable *in vitro*, usually inactivated by temperatures below 55° C., and show little tendency to systemic spread in their hosts. Lack of virus antigen in the juice, antigenic inactivity of the virus juice, or instability may be among the factors responsible for the absence of serological reactions in this virus category.

The field method of precipitin testing gave reliable results in the hands of unskilled workers. Data are given and suggestions made for its use as a laboratory procedure, the elimination of artifact reactions, and future extended applications of the technique employed.

HATCH (A. B.). **The physical basis of mycotrophy in Pinus.**—*Black Rock For. Bull.* 6, ix+168 pp., 17 pl., 7 figs., 13 graphs, 1937.

In the first two parts of this paper the author discusses the existent literature (from the beginning) dealing with ectotrophic mycorrhiza [*R.A.M.*, xvii, p. 54] and critically reviews the different theories that have been put forward as to the factors controlling their distribution and abundance. In the third part a large number of experiments are described and the conclusions reached may be summarized as follows. The abundance of mycorrhiza on the roots of pine seedlings in normal forest soils depends on the availability of mineral salts, mycorrhiza being freely produced in the presence of a low availability of nitrogen, phosphorus, potassium, or calcium, or of a lack of balance in their availability. The susceptibility of short roots is induced by a combination

of low or unbalanced concentrations in the vascular plants and high concentrations in the fungus, such as appears typically in soils with low concentrations of nutrient ions. There was no evidence that differences in the mycorrhizal equipment affected growth.

In soil culture experiments with prairie soil lacking mycorrhiza, and with introduced mycorrhiza in parallel series, seedlings in the latter were healthy and contained mineral salts ranging from 86 to 234 per cent. more than plants devoid of mycorrhiza, which were stunted and yellow.

In pure culture studies pine seedlings were readily able to utilize peptone and nucleic acid in the absence of ammonium in the substrates. Mycorrhiza were abundantly produced in a sand substrate with appreciable base-exchange properties and rich in undissolved minerals, but not when the base-exchange capacity was low, and either without insoluble or with dissolved minerals.

Infection by mycorrhizal fungi was ascertained to increase the absorbing surface area of the short roots of pine seedlings by continued elongation, increase in diameter, multiple tip development, increase in the life of the cortex by delaying suberization, and lastly, by the fungi acquiring the surface areas either as (1) a parenchyma-like mantle, (2) individual hyphae extending from the mantle into the soil, or (3) mycelium connected with the mycorrhiza by rhizomorphs.

As a result of his study as a whole the author tentatively puts forward the following views. The symbiotic mechanism increases the absorption of soil nutrients chiefly by physical and relatively non-selective means. The greater absorption capacity of mycorrhizal seedlings is induced by increases in the effective absorbing surface areas of short roots resulting from fungal invasion. In fertile soils with abundant dissolved nutrients mycorrhiza are seldom produced and long root tips are the chief organs of absorption. In infertile soils having few dissolved salts, where the nutrient elements are held in base-exchange compounds, mycorrhizal short roots become numerous, their number and development being inversely proportional to the soil fertility. As the availability of nutrients decreases, mycorrhizal short roots have an increasing share in seedling nutrition, and eventually become the only organs of absorption. That fungi are more efficient than roots in extracting nutrients from rocks and base-exchange materials is attributed primarily to the fact that the surface area to volume ratio is much greater in fungi than roots. Trees depend on symbiotic association with mycorrhiza for their soil nutrients and therefore for their existence in all but the most fertile agricultural soils.

TVERSKOY (D. L.). Влияние коротких и ультракоротких радиоволн на грибы и бактерии, патогенные для растений. [Effect of short and ultra-short radio waves on fungi and bacteria pathogenic to plants.]—*Pl. Prot., Leningr., 1937*, 13, pp. 3–28, 1937. [English summary.]

The experiments described in some detail in this paper showed that short (8 to 40 m.) and ultra-short (5·2 to 10 m.) radio waves had a lethal effect on *Bacillus carotovorus* [*Erwinia carotovora*], *Fusarium solani*, *Botrytis cinerea*, *Sclerotinia libertiana* [*S. sclerotiorum*], and *Phytophthora infestans*, dependent on the temperature developed in their substratum

(natural, agar, or salt solutions) under the influence of irradiation, but not when the heat effect was eliminated by water jackets. *In vitro* the micro-organisms were killed at temperatures inside the test-tubes from 45° to 50° C. or higher, the inference being that the temperatures of the substrata were much lower than those developed inside the micro-organisms themselves by the waves. With *E. carotovora* it was also observed that the killing effect was more rapid as the density of the suspensions was greater, but was nil when silk threads dipped in a suspension of the bacteria and dried were directly irradiated. The organism was killed most rapidly when present inside cereal grains.

These results are interpreted as indicating the possibility of using short and ultra-short radio waves for the disinfection of wheat seed-grain infected with loose smut [*Ustilago tritici*], or with *Helminthosporium* and *Fusarium* spp., there being evidence that by increasing the potential of the electrical field, the sterilization of the affected grain may apparently be attained within a very short time (a few seconds). It was further found that exposure of wheat grain in an electrical field to a temperature of 65° C. for two to four minutes only slightly reduced its germinability. Further work is in hand to test the possibilities of this method.

NISIKADO (Y.) & HIRATA (K.). **Studies on the longevity of sclerotia of certain fungi, under controlled environmental factors.**—*Ber. Ōhara Inst.*, vii, 4, pp. 535–547, 1937.

A fully tabulated account is given of the writers' studies on the longevity of the sclerotia of *Sclerotinia trifoliorum* [see above, p. 114] from *Astragalus sinicus*, *S. libertiana* [*S. sclerotiorum*] from sunflower (*Helianthus annuus*) [*R.A.M.*, xv, p. 167], carrot [ibid., xv, pp. 459, 477] and melon (*Cucumis melo*) [ibid., viii, p. 419], *S. minor* [ibid., xvi, p. 160] from *Chrysanthemum cinerariaefolium*, *S. oryzae* [*Leptosphaeria salvinii*: ibid., xvi, p. 405] from rice, *Hypochnus* [*Corticium*] *sasakii* [ibid., xv, pp. 48, 395] from wheat, and *H. centrifugus* [*C. centrifugum*: ibid., xvi, p. 405] from *Amorphophallus konjac*, all in Japan. The fungi were grown for two to four weeks on steamed rice straw at 24° C. and then transferred to (*a*) incubators at temperatures rising by 5° from 0° to 35°, (*b*) sterilized tap water in test-tubes maintained at various temperatures, and (*c*) the same with 0·5 per cent. sodium chloride instead of water. At monthly intervals two pieces of sclerotia were transferred to malt extract agar at 24°, and their germinative capacity determined.

In all the species tested, viability decreased *pari passu* with rising temperature, only *L. salvinii* and *C. centrifugum* being still capable of germination after four and five months, respectively, in tap water at 35°. The sclerotia of *L. salvinii* in the air-dried (incubator) series retained their viability for three years at under 20°, 10 to 13 months at 25° to 30°, and four months at 35°, the corresponding periods in tap water below 5°, under 20°, and 30° being three years, two years, and one year, respectively. In the case of *C. centrifugum* the sclerotia in the air-dried state survived over two years below 10°, three years at 15° to 25°, 26 months at 25°, 16 months at 30°, and 6 months at 35°, the corresponding figures in tap water being two years at 10° to 25°, 16

months at 30°, and five months at 35°. The sclerotia of *S. trifoliorum* on air-dried rice straw retained their viability for over 18 months at below 20°, 14 months at 25° to 30°, and 4 months at 35°, the corresponding figures in tap water being over 13 months at under 5°, 12 to 14 months at 10° to 25°, and 3 months at 30°. The results obtained with the three above-mentioned strains of *S. sclerotiorum*, though not identical, agreed in the main. In series (*a*) the sclerotia survived for two years or more at 20°, over 14 months at 25°, 10 to 14 months at 30°, and 3 to 4 months at 35°, the corresponding figures for (*b*) being 12 to 14 months at below 20°, 8 to 14 months at 25°, 3 to 5 months at 30°, and under a month at 35°, and (*c*) over a year at below 25°, 4 to 5 months at 30°, and less than a month at 35°. The viability relations of *S. minor*, tested on air-dried rice straw only, resembled those of *S. sclerotiorum*. In series (*a*) the sclerotia of *C. sasakii* were still viable after three years at or below 20°, 26 months at 25°, 16 months at 30°, and 6 months at 35°, the corresponding figures for (*b*) being 3 years below 25°, 22 months at 10°, 12 to 13 months at 15°, 6 months at 25°, 3 months at 30°, and less than a month at 35°. It is apparent from these survival data of the fungus, both in humid and dry conditions, that its elimination from the rice fields presents considerable difficulty.

From the foregoing observations it is evident that the sclerotia of the species of the Basidiomycetous genus *Corticium* are more resistant to adverse environmental factors than those of the Ascomycete *Sclerotinia*. In nearly every case immersion in tap water or brine caused a more rapid loss of sclerotial viability than preservation in an air-dry state.

FRANCKE (H. M.). **Untersuchungen über die Physiologie der pflanzlichen Virose.** [Studies on the physiology of plant viroses.]—*Biochem. Z.*, ccxciii, 1–2, pp. 39–63, 1 fig., 2 diags., 14 graphs, 1937.

A fully detailed account is given of the writer's highly technical experiments to determine, by electro- and colorimetric methods, the hydrogen-ion concentrations of Samson Bashi Bagli tobacco, *Nicotiana glutinosa*, *N. rustica*, *Datura stramonium*, tomato, bean (*Phaseolus vulgaris*), and beet plants inoculated with a weak strain of ordinary tobacco mosaic [*R.A.M.*, xvi, p. 778] in comparison with a corresponding healthy series.

The resultant data denoted a marked tendency to acute alkalosis, intensified buffering (up to 144 per cent. of the normal), especially between P_H 3 and 4, and changes in the titration relations of diseased tobacco and beet plants. Analogous observations apply to tomato, the other member of the susceptible group used in the tests. In the locally resistant category, represented by *N. glutinosa*, *D. stramonium*, and bean, and in *N. rustica*, reacting to infection by systemic necrosis, buffering was intensified at P_H 5. Potentiometric measurements on tobacco plants indicated weak reduction intensity for old, yellow leaves, moderate for stem and lower and middle foliage, strong for roots and upper leaves, and very strong for flowers. The end potentials of mosaic-diseased bean, beet, and tobacco leaves were found to be more positive (^rH 14·0, 4·8, and 7·9, respectively) than those of healthy plants (^rH 8·0, 2·8, and 5·3). The course of the curve for diseased but morphologically uninjured tobacco and beet leaves points to the operation in

these organs of an oxidation reduction system falling within the more positive potential range and absent from, or inactive in, those of healthy plants.

VIENNOT-BOURGIN (G.). **Les déformations parasitaires provoquées par les Ustilaginées.** [The parasitic deformations caused by the Ustilaginales.]—189 pp., 65 figs., 2 graphs, 1 map, Paris, Librairie E. Le François, 1937.

In this book the author describes in considerable detail the results obtained in eight years' study of the parasitism of a number of Ustilaginales.

Tilletia caries on *Triticum* spp. reduces by up to 85 per cent. the number of stems produced and causes dwarfing and modification of the internal structure of the culm, the medulla showing exaggerated development resulting in the formation of a semi-solid stem with thickened nodes filled with a spongy tissue. Leaves and internodes are reduced in number. At ripening the culm bends, and later breaks. Affected stems are highly susceptible to infection by other fungi.

Ustilago nuda f.sp. *tritici* [*U. tritici*: *R.A.M.*, xv, p. 84] attacks the various foliaceous organs of the flower of wheat in turn, and not specially or primarily the ovary. The pistil in a flower that has been otherwise almost completely destroyed can continue development of all its parts.

The author concludes that the formation of the tumours studied depends on the prolonged and continuous activity of the initial generative axes. If these are lacking, localized cellular elements appear, and play the same part. The initial process of deformation is always a stimulation of young and active cellular tissues resulting in the proliferation of complex, characteristic structures with a well-defined exterior contour. Host reaction to the Ustilaginales may lead to the formation of generally superficial, sometimes voluminous tumours. In other cases the deformations affect the whole plant forming proliferations in new or existing tissues, but no apparent tumour. Tumour development always corresponds with chlamydospore formation. The passage from the tissues of the tumour to normal tissues may be either sudden (as with *Tuburcinia* spp. and *U. maydis*) [*U. zeae*] or slow and progressive (stem tumours caused by *Melanotaenium* spp., and leaf lesions due to *U. tritici*). Hyperplasia precedes or results from the formation of a sporogenous plexus. The formation of giant cells occurs under the influence of punctures, or external or internal lesions causing the diffusion of toxins. The appearance of a tumour may affect tissues that do not contribute to the gall formation in which case the whole plant shows a new but homogeneous conformation, or, on the other hand, the infected organ may show a heterogeneous structure due to the gall formation and to a complex organization structurally different from both gall and original tissues.

STELZNER (G.). **Resistenzzüchtung bei Kartoffeln.** [Breeding for resistance in Potatoes.]—*Forschungsdienst*, iv, 6, pp. 261–266, 1937.

An account is given of recent developments in Germany and elsewhere in the work of breeding potatoes for resistance to late blight

(*Phytophthora infestans*) [*R.A.M.*, xvii, pp. 57–61], virus diseases, frost, the Colorado beetle (*Leptinotarsa decemlineata*), and drought, supplemented by a list of disorders to which attention should be urgently directed in the near future. According to field observations [in France] by R. Diehl (*Sélectionneur*, v, p. 81, 1936), the Swedish Imperia variety is resistant to leaf roll [ibid., vii, p. 596], Arran Comrade, Bevelander, Max Delbrück, Triumph, and Roode Star to streak [ibid., xvi, pp. 829, 831; xvii, p. 57], and Bevelander and Noordeling to crinkle mosaic [see above, p. 126].

FINDLAY (D. H.) & SYKES (E. T.). **The control of Potato blight by spraying and destruction of haulm.**—*J. Minist. Agric.*, xliv, 6, pp. 546–551, 1937.

During the summer of 1936 potatoes in the Marshland area of West Norfolk were widely and severely affected by blight (*Phytophthora infestans*). King Edward potatoes given two applications of Bordeaux mixture in the last week of June and in mid-July yielded 5·86 tons of ware potatoes per acre, as against 6·7 tons for those given a third spraying at the end of July. The passage of the spraying machine reduced the yield of ware potatoes by 1·4 tons per acre, but on an acreage basis loss from this cause diminishes in proportion to increased size of the machine used. Spraying the haulms with sulphuric acid [*R.A.M.*, xvi, p. 555] or copper sulphate four weeks before lifting did not reduce the proportion of blighted tubers in the clamp. The evidence obtained indicated that when infection occurs early and the foliage is being rapidly killed, the destruction of the haulms four weeks before lifting is of little use, and may indeed result in a reduced crop. On the other hand, when the haulms of King Edward potatoes remain green until lifting the greatest amount of tuber blight is to be expected, and haulm destruction three weeks before lifting is of service.

SILBERSCHMIDT (K.). **A degenerescencia da Batatinha.** [Degeneration of the Potato.]—*Biologico*, iii, 9, pp. 247–254, 1 pl., 1 fig., 1937.

The author states that in the State of São Paulo, Brazil, potatoes are sown twice a year, from January to March for the summer crop, and in August and September for the winter crop. The first, main sowing is generally made with certified seed tubers imported at heavy cost from Europe, and the second with tubers of the Paraná Ouro [Paraná Gold] and Paraná Branca Cascuda [Paraná White Thick-skinned] varieties imported from Paraná [Argentina]. Phytopathological inspections in two localities showed that crops produced from the Paraná seed tubers contain a high percentage of virus diseases [*R.A.M.*, xvii, p. 57] which, by their external symptoms alone, are tentatively identified as leaf roll, rugose mosaic, a form closely resembling mild mosaic, and a form resembling crinkle mosaic. It is suggested that these crops may be the source of infection for the European certified planting material, which rarely produces more than one full crop, and for the most part becomes entirely worthless by the third generation in the country. It is therefore recommended that when harvesting the winter crops, care should be taken to remove all the tubers from the soil, to prevent the appearance of volunteer plants in the summer crops, or

better still that the latter should not be sown within a certain distance from the former. Studies are in progress to find localities in the State where the European varieties may be grown for local seed-tuber production without danger of outside infection.

Köhler (E.). **Über den gegenwärtigen Stand der Erforschung des Kartoffelabbaus.** [On the present status of research on Potato degeneration.]—*Forschungsdienst*, iv, 2, pp. 81–90, 1937.

This is a survey of recent contributions to the solution of the potato degeneration problem [*R.A.M.*, xvi, p. 828 *et passim*], the various aspects of which have all been referred to from time to time in these pages.

Mader (E. O.). **Potato yellow dwarf and medium Red Clover.**—*Amer. Potato J.*, xiv, 9, pp. 293–295, 1937.

A general survey of New York State for the presence of yellow dwarf of potatoes [*R.A.M.*, xvi, p. 56], begun in 1936 and still incomplete, showed the clover leafhopper [*Agallia sanguinolenta*] to be ubiquitous, but only individuals from certain sections are viruliferous. The disease, moreover, is largely restricted to areas where medium red clover (*Trifolium pratense*) is grown. Should this preliminary evidence be confirmed, it may be possible to combat yellow dwarf by the substitution of other clovers for the medium red, rather than by the more difficult elimination of the insect vector.

Dhein (A.). **Einfluss der Kalisalzdüngung auf die Widerstandsfähigkeit der Kartoffel gegen Schorf.** [The influence of potash salt manuring on the resistance of the Potato to scab.]—*Pflanzenbau*, xiv, 3, pp. 99–111, 1937.

A fully tabulated account is given of the writer's experiments at Bonn University to determine the influence of manuring with potash salts on the incidence of scab [*Actinomyces scabies*] in Industrie potatoes [*R.A.M.*, xiii, p. 51; xvi, p. 404]. In comparison with the repressive effects on the disease of ammonium sulphate and superphosphate the action of potash is relatively weak. In general, potassium sulphate+magnesium sulphate exerts the most beneficial effect, but on clay soils the use of 40 per cent. potash salt gives better results. Potassium sulphate alone does not afford adequate protection against scab on physiologically alkaline soils, whereas on those with an acid reaction it is approximately equal in efficacy to the potassium and magnesium sulphate combination. No definite correlation could be traced between the degree of severity of scab and soil reaction, and it is doubtful, therefore, whether the influence of fertilizers on the disease is connected with this phenomenon.

Pittman (H. A.). **The Rhizoctonia and common scab diseases of Potatoes.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xiv, 3, pp. 288–301, 7 figs., 1937.

In giving a brief, popular account of the various forms of attack of the potato by *Corticium vagum* [*C. solani*] the author states that in Western Australia the fungus is most injurious to the plants sown in the spring or autumn, both by reducing the stands in the initial stages of growth and by forming stem cankers in plants that are attacked in

more advanced stages of development. The formation of sclerotia on the tubers is apparently stimulated by falling temperatures, and the most heavily scabbed tubers are dug from drained peaty swamps in the autumn. The control measures recommended include crop rotation, avoiding sowing the potatoes in the spring or autumn, especially on infected soil or if the seed tubers have not been disinfected, as early harvesting as feasible, and seed-tuber disinfection with cold or hot formalin, or cold mercuric chloride solutions, the preparation of which is discussed.

An account is also appended of common scab (*Actinomyces scabies*), together with recommendations for its control, much on the same lines as for *C. solani*, except that the use of manures or soil dressings tending to raise the alkalinity of the soil, which favours common scab, is not advised.

CRISTINZIO (M.). **Esperienze intorno alla capacità infettiva della Rhizoctonia solani Kühn a mezzo di tuberi di Patata infetti.** [Experiments on the infective capacity of *Rhizoctonia solani* Kühn carried out by means of infected Potato tubers.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), vi, pp. 71–94, 2 pl., 2 figs., 1937.

When seed tubers of the Borger, Böhms, Pepo, and Riccia di Napoli potato varieties were planted in two successive years at Portici in lots averaging, respectively, 95, 60, 30, 10, and 0 and 80, 50, 25, 10, and 0 sclerotia of *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xvi, p. 770] it was found that the use of the infected seed tubers favoured early attack on the young shoots of the plants, with a resultant high percentage of deaths. The yield from the infected seed tubers was normal quantitatively, but of subnormal quality. Plants that escaped early infection produced mostly small, commercially valueless tubers in numbers closely correlated with the amount of stolon infection. The plants from the infected seed tubers always gave more diseased than healthy tubers, the intensity of infection of the progeny being directly proportional to that of the seed pieces, while many of the young tubers showed more sclerotia than the parent tubers. In both seasons the uninfected controls gave no plant that succumbed to early infection, the produce was good in quantity and quality, and the number of infected tubers was practically negligible.

It is concluded that the results obtained with the plants from the infected tubers were in fact due to the presence of the fungus on the seed and not to soil-borne infection. The most resistant variety was Riccia di Napoli, followed in order of increasing susceptibility by Böhms, Pepo, and Borger. In general, the early varieties were the least resistant.

SUZUKI (H.). **Studies on the relations between the anatomical characters of the Rice plant and its susceptibility to blast disease.**—*J. Coll. Agric. Tokyo*, xxiv, 3, pp. 181–264, 15 pl., 6 figs., 1937.

This is an exhaustive discussion, accompanied by 47 tables, of the author's further studies on the relation between the anatomical features of rice plants and their reaction to blast [*Piricularia oryzae*] on dry and flooded soils in Japan, the varieties used being Kamaji, Kamejiichigô, and Mubôaikoku (all resistant) and Nakateshinriki, Omachi, Miyako,

and Kokuryômiyako (susceptible) [*R.A.M.*, xvi, p. 201]. The results fully confirmed his earlier conclusions and showed that the thickness of the outer walls and the silicated outermost layer of the epidermal cells, and the number of silicated bulliform cells, silicated long or short cells, and silicated stomata are greater in resistant than in susceptible varieties and on flooded than on dry soil (earlier work having shown that susceptibility is in inverse proportion to soil moisture), while the number of stomata does not appear to be correlated with the susceptibility to disease.

Marland (A. G.). К вопросу о взаимоотношениях почвенных грибов. [On the problem of the interaction of soil fungi.]—*Pl. Prot., Leningr., 1937*, 13, pp. 88–91, 1937.

In the experiments briefly described in this paper *Fusarium culmorum*, *Zygorrhynchus moelleri* [*R.A.M.*, xvi, p. 558], and *Z. heterogamus* gave luxuriant growth when cultured separately on malt peptone agar or carrot decoction agar. When *F. culmorum* was transferred to the medium taken from under the *Z. heterogamus* culture it again produced vigorous growth, but developed only sparsely on the substratum from under the *Z. moelleri* culture. Both species of *Zygorrhynchus* failed to develop when transferred to the *F. culmorum* substratum. In a parallel series of tests, wheat grown on soil inoculated with *F. culmorum* alone showed 66 per cent. infection; this percentage was raised to 75 when *Z. heterogamus* was added to the inoculum, and reduced to 60 when the additional organism was *Z. moelleri*. The problems raised by these results are being investigated from a theoretical standpoint.

Naftel (J. A.). **Soil liming investigations: V. The relation of boron deficiency to over-liming injury.**—*J. Amer. Soc. Agron.*, xxix, 9, pp. 761–771, 6 figs., 2 graphs, 1937.

Excessive applications of lime to a Norfolk loamy sand soil in Alabama resulted in over-liming injury, sometimes entailing virtual crop failure, to vetch, turnips, oats, cabbage, tomatoes, and soy-beans. The adverse effects of the treatment were not overcome by the addition of large amounts of phosphorus, soil and plant applications of manganese, or soil amendments of calcium silicate, but the incorporation with over-limed soil of micro-elements including boron (1 p.p.m.) completely prevented the damage, the results being particularly striking in the case of turnips [*R.A.M.*, xvi, p. 722]. In all the crops the over-liming symptoms were typical of boron deficiency.

The mechanism involved in rendering boron unavailable to plants has not been explained. Laboratory experiments indicate that the possibility of insoluble borate precipitation may be discounted, but recent evidence points to an extreme stimulation of bacterial activity by over-liming, reaching the point of acute competition between micro-organisms and higher plants for nutrients present in small amounts.

Cameron Brown (C. A.). **Electrical heating for horticultural purposes.**—*J. Minist. Agric.*, xliv, 6, pp. 552–561, 1937.

After briefly comparing the advantages and disadvantages of electrical and other forms of heating for horticultural purposes the author

discusses, with particular reference to the question of expense, methods of glasshouse and soil heating by electricity. Soil sterilization can be effected electrically in a convenient way by passing the current through copper plates placed at appropriate distances apart in the soil [cf. *R.A.M.*, xv, p. 824 *et passim*]. This method is best suited for use with special boxes containing up to about 10 cwt. of soil. The electrodes may be at either end, the soil being firmly packed between, or one may be on the bottom and the other on the underside of the lid which, when closed, makes contact with the soil. The amount of current and time necessary and the cost of the process depend on the kind of soil, its moisture content, and the efficacy of the packing, but with average potting soil, well packed, the consumption of electricity would amount to about 30 units per cu. yd. This clean, handy method should appeal to amateurs and small growers.

Baldacci (E.). **Ricerche intorno ad una infezione del Ricinus communis attribuita a Fusarium ricini (Berengèr) Bizz.** [Researches on an infection of *Ricinus communis* attributed to *Fusarium ricini* (Berengèr) Bizz.]—*Atti Ist. bot. Univ. Pavia*, Ser. IV, x, pp. 37–49, 1 fig., 1937. [English and Latin summaries.]

In this expanded account of his investigations into a disease of castor (*Ricinus communis*) in Italy [*R.A.M.*, xvi, p. 560] the author states that the condition, which appeared to be identical with one attributed in 1865 in Italy to *Fusisporium ricini*, renamed by Bizzozero *Fusarium ricini* in 1885, developed on a large scale after rainy weather in plants that were still flowering. Dark brown spots formed on the stems, leaves, and inflorescences, the leaves became badly lacerated, and floral development was arrested, but after about three weeks new leaves and flowers were put out. From infected material the author isolated *Verticillium roseum*, *Fusarium scirpi*, *F. moniliforme* [*Gibberella moniliformis*], and *F. semitectum*, an undetermined *Fusarium* and *Macrosporium cavarae* [ibid., ix, p. 489] also being isolated from infected seeds. Infection was probably due to at least two fungi, *M. cavarae* producing the leaf-spotting and attacking the apices of the seeds, and a *Fusarium* species producing lesions on the stems, inflorescences, capsules, and seed apices, this fungus probably being followed by the others.

Inoculations of castor seedlings with *F. scirpi*, *F. semitectum*, *G. moniliformis*, and *F. sambucinum* gave negative results except in a few cases in which the plants had been much weakened by unfavourable environmental conditions. Both *M. cavarae* and the *Fusarium* species involved are regarded as weak parasites. *Fusarium ricini* should be excluded from the valid nomenclature as a *nomen compositum*.

Borzini (G.). **Osservazioni sul parassitismo della 'Sclerotinia libertiana' Fuck. associata ad altri funghi.** [Observations on the parasitism of *Sclerotinia libertiana* Fuck. associated with other fungi.]—*R.C. Accad. Lincei*, xxv, 8, pp. 401–404, 1937.

Towards the end of 1936, fennel (*Foeniculum vulgare*) plants growing near Rome showed a light infection of the outer covering of the bulb by *Sclerotinia sclerotiorum* [*R.A.M.*, ix, p. 202] and, in some cases, a

much more serious infection by the same fungus in association with two undetermined species of *Pythium*.

When wounded bulbs were inoculated with mycelium of *S. sclerotiorum* alone infection progressed much more rapidly than when the inoculations were made with an intimate mixture of mycelia of *S. sclerotiorum* and each species of *Pythium*, or *Phytophthora parasitica*, or *P. citrophthora*, the fungi showing distinct mutual antagonism. In some of the mixed inoculations the two fungi separated in the host parenchyma, in which case the progress of each was less retarded. When the two inocula were placed in the wound without being intimately mixed they developed independently of each other on opposite sides of the incision, the lesions enlarging only slightly less rapidly than lesions due to *S. sclerotiorum* alone. When two cuts 4 to 5 cm. apart were made in each bulb and the mycelium of *S. sclerotiorum* was inserted in one and that of one or other of the remaining fungi in the other, the two lesions at first spread as quickly as those due to the single control inoculations, but as soon as they drew near to one another there was marked increase in the pathogenic activity of *S. sclerotiorum*, which rapidly invaded the whole plant, surrounding the other fungus and completely arresting its growth. The host tissues rapidly became disorganized and were reduced to a mass of sclerotia, though other fennel plants inoculated on the same date with *S. sclerotiorum* alone showed only localized infection in the bulb. One *Pythium* species and the two *Phytophthora* species when inoculated separately into fennel were only very weakly pathogenic.

These results were confirmed when the fungi were grown on fennel agar. When *S. sclerotiorum* and one of the other fungi were sown 4 cm. apart in the same dish *S. sclerotiorum* made better growth with the two species of *Phytophthora* than with the two *Pythium* species and better growth with the latter than when cultured alone.

It is concluded that the *Pythium* infections observed in nature contributed to the appearance or spread of the sclerotial disease, which has not been recorded before on fennel in Italy. *S. sclerotiorum* becomes more virulent by absorption of the metabolic products of fungi associated with it.

Shepherd (E. F. S.). **The gumming disease of the Sugarcane.**—*Bull. Dep. Agric. Mauritius* 25, 9 pp., 1937.

In this account of the symptoms, etiology, and control of gumming disease of sugar-cane (*Bacterium vasculorum*) [*R.A.M.*, xvii, p. 67] the author states that the condition has been a factor in the disappearance of many important cane varieties from cultivation in Mauritius. Little damage is now caused over the island taken as a whole, owing to the fact that more resistant varieties are grown, but the loss of yield resulting from the fact that some of these, including White Tanna, are of poorer quality than the susceptible varieties they replaced, is indirectly a loss due to the disease.

D. S. North has proved in Fiji, New South Wales, and Queensland that the disease can be eradicated in an infected area by the continuous and exclusive use of resistant varieties. In Mauritius, new seedlings are tested for resistance to gumming after their second year's general performance trial, two holes of each being tested. A flank row of 55/1182

is planted along each side of the plot at right angles to the two-hole lines of seedlings. In addition, a standard variety of known reaction to gumming is also planted each year in the plot. The shoots in the flank rows are inoculated when about five months old by stabbing the spindles with an instrument dipped into a suspension of gum exudate in water. In about a fortnight gumming stripes develop on the leaves, which 'bombard' the seedlings with infection. The gum used is selected from several different localities. Seedlings not highly resistant are subjected to a further test. The stems of all seedlings found to be commercially resistant are immediately examined, as a resistant variety may develop systemic infection in a number of shoots. The plots are inspected at least once every two months.

Chupp (C.). **Cercospora species and their host genera.**—Issued by Dep. Plant Path., N.Y. (Cornell), 23 pp., 1937. [Mimeographed.]

This is a list of 1,384 species of *Cercospora* [*R.A.M.*, xvi, pp. 128, 398, 562, 633] arranged alphabetically according to the specific name with numbers indicating the host genera, which are listed separately on pp. 15–23 with cross-references by numbers to the species found on them.

Mitter (J. H.) & Tandon (R. N.). **Fungi of Allahabad, India.—Part III.**—*Proc. Indian Acad. Sci.*, Sect. B, vi, 3, pp. 194–201, 1937.

A list is given of 117 fungi collected at Allahabad since the publication of part II of 'The fungous flora of Allahabad' [*R.A.M.*, x, p. 210].

Baldacci (E.). **Un nuovo genere di micete parassita del Pioppo, Pollaccia radiosa (Lib.) Baldacci e Ciferri. Revisione dei G. Stigmella e Stigmina.** [A new genus of fungus parasitic on Poplar, *Pollaccia radiosa* (Lib.) Baldacci & Ciferri. A revision of the genera *Stigmella* and *Stigmina*.]—*Atti Ist. bot. Univ. Pavia*, Ser. IV, x, pp. 55–72, 5 figs., 1937. [Latin and English summaries.]

Examination of herbarium material of the fungus originally described as *Oidium radiosum* [*R.A.M.*, xvi, p. 423] showed that the conidiophores were either lacking or reduced to a papilla, while the conidia measured 23 to 25 by 7 to 10 (when more developed up to 42 by 12) μ, were sessile or borne on a hyaline papilla, uniseptate when young, and when mature typically biseptate with a central cell measuring 15 by 9 μ and two end cells 7·5 by 5 to 6 μ, of which the apical one was subrotund and the basal one conical or acute, both being a lighter colour than the central one. The fungus differs fundamentally in the characteristic shape, unequal septation, and colour of its conidia from *Stigmella* and *Stigmina*, and from *Fusicladium* and *Napicladium* in that these have fusiform or piriform conidia. It is therefore transferred to a new genus *Pollaccia* Bald. & Cif. [a Latin diagnosis of which is given], characterized by biseptate conidia with unequal, elongated, thickened cells, of which the centre one is dark and the two end ones light, as *P. radiosa* (Lib.) Bald. & Cif. Synonyms of the fungus include *Cladosporium ramulosum*, *C. asteroma* and its var. *microsporum*, *Fusicladium tremulae*, and *Stigmina radiosa* [loc. cit.].

From his study of authentic material of *Stigmella dryophila*, *S. montellica*, *Stigmina platani*, and *S. briosiana* the author concludes that

all these species belong to the genus *Stigmella* Lév. emend. Baldacci [a revised Latin diagnosis of which is given] characterized by globose, ovoid, or cylindrical, very dark conidia transversely bi- or pluriseptate, with or without longitudinal septa. The genus is subdivided into four subgenera, *Eustigmella*, *Stigmina*, *Montellia*, and *Farnetina*, represented, respectively, by *Stigmella dryophila*, *S. platani*, *S. montellica*, and *S. briosiana* (Farneti) Baldacci (= *Stigmina briosiana* Farneti).

SUBBA RAO (M. K.). **Report of the Mycologist, 1936–37.**—*Adm. Rep. Tea sci. Dep. unit. Plant. Ass. S. India, 1936–37*, pp. 25–33, 1937.

During the period under review the leaf spot of tea caused by *Cercosporella theae* [*R.A.M.*, xvi, pp. 1, 636, 798] was recorded from the Nilgiris and Anamallais. The disease appears to be favoured by misty weather rather than actual precipitation.

Although the black rot due to *Corticium invisum* [ibid., xv, p. 748] is reported only from one estate in Travancore, the disease is believed to be widespread elsewhere, especially in districts exposed to a heavy rainfall.

No tendency to spread has been shown by witches' broom, a cytological study of leaves affected by which has been commenced. The chloroplasts in the diseased foliage are small and few, while the palisade cells are occupied by numerous yellowish-brown, often pale green-tinted, globular bodies of varying dimensions, which are present only to a very limited extent in corresponding healthy material.

Of the various common antiseptic paints tested for the treatment of pruning cuts, the most effective and simplest to apply were carbolineum [ibid., xvi, p. 783], cargillineum [cf. ibid., xv, p. 734], and Mason's mixture, the last-named being particularly recommended for estate practice as requiring no heating prior to use and retaining its colour well for checking purposes.

Parodiella grammodes caused almost complete defoliation of *Crotalaria anagyroides* [ibid., xi, p. 748], which was also attacked by a species of *Fusarium* inducing wilt.

Tryblidiella rufula [cf. ibid., xv, p. 344] was found on *Grevillea* branches and on citrus shoots previously infected by *Corticium salmonicolor*.

LEHMAN (S. G.). **Ruffle-leaf: a new disease of Tobacco in North Carolina.**—*Plant Dis. Reptr*, xxi, 16, pp. 296–297, 1937. [Mimeographed.]

From 7 to 10 per cent. of the tobacco plants in fields covering an area of about 20 acres near Raleigh, North Carolina, were observed in August, 1937, to be suffering from a disease strongly reminiscent of 'kroepoek' [leaf curl], as described from South Africa and the Dutch East Indies [*R.A.M.*, xvi, p. 414] but which the writer prefers to term 'ruffle leaf' pending further studies on its exact identity.

CHAMBERLAIN (E. E.). **Tobacco mosaic. Its appearance, cause, and control.**—*N.Z. J. Agric.*, lv, 3, pp. 163–174, 1937.

Tobacco mosaic is stated to have become a major problem in the Nelson district of New Zealand [*R.A.M.*, xvi, p. 418] only in the last five years, the estimated average infection having increased from under 10 per cent. in 1933 to well over 25 per cent. in 1937. The disease is also

present, though much less widely, in Auckland Province. Leaf-spotting is a very destructive feature in New Zealand, and in one crop of Burley tobacco, examined in 1933, was so severe that 20 per cent. of the crop remained unpicked. Experiments at Palmerston North showed that infection when occurring shortly after the plants had been set out in the field caused 44 and 78 per cent. reduction of yield in a Virginian and a Burley variety, respectively; leaf from the affected plants was useless. Infection later in the season caused corresponding losses of 24 and 25 per cent. Other hosts attacked locally are tomato, black nightshade [*Solanum nigrum*], Cape gooseberry [*Physalis peruviana*], Turkestan tobacco, eggplant, and chilli [*Capsicum annuum*], of which only the first two are likely to play any part in transmission to tobacco.

Healthy plants, from which the laterals were removed by two men who had previously performed the same operation on mosaic plants, developed 83 per cent. infection after three weeks. Experimental evidence showed that where the disease has been present in a seedling-bed it may remain in the soil and infect the seedlings in the following season; in one instance in which seedlings were planted in such a bed, the plants developed over 11 per cent. infection after being transplanted to the field. In another case, when 129 healthy tobacco plants replaced infected ones in the field 72 per cent. of the former became diseased. Preliminary trials indicated that the disease may be carried to a small extent in or with the seed. It is also borne in a small percentage of seed from infected tomatoes and *S. nigrum*.

The paper terminates with recommendations for control.

SHAPOVALOV (M.) & LESLEY (J. M.). **A Tomato resistant to two wilts.**—Abs. in *Phytopathology*, xxvii, 9, p. 955, 1937.

Brief particulars are given of the Riverside tomato variety, recently developed by the United States Department of Agriculture in co-operation with the University of California for resistance to the two wilt diseases infesting certain soils of the coastal belt, viz., *Verticillium albo-atrum* [*R.A.M.*, xv, p. 519] and *Fusarium* [*bulbigenum* var.] *lycopersici* [ibid., xvi, pp. 157, 419]. The new hybrid, originating from a cross between Cal 2, somewhat resistant to *V. albo-atrum*, and Marvana, resistant to *F. bulbigenum* var. *lycopersici*, gave much more satisfactory results in repeated trials on wilt-infested soils than several leading commercial varieties tested simultaneously. Riverside is a late maturing type and so primarily adapted for late shipping purposes. Cultural studies in connexion with these experiments indicated that the prevalence of *Fusarium* wilt tends to increase during the hotter part of the growing season, whereas *V. albo-atrum* is liable to predominate, often to the exclusion of the *Fusarium*, with the onset of cooler conditions.

TISDALE (W. B.) & HAWKINS (S. O.). **Experiments for the control of Phoma rot of Tomatoes.**—*Bull. Fla agric. Exp. Sta.* 308, 28 pp., 1937.

A full account is given of experiments carried out in Florida from 1931 to 1935, inclusive, on the control of *Phoma* rot (*P. destructiva*) of tomatoes [a preliminary note on which has already appeared: *R.A.M.*, xiv, p. 475; xvi, p. 419]. Since the disease was first recorded on tomatoes dispatched from the lower east coast of Florida in 1915, it has become

the chief cause of spoilage in tomatoes sent from Florida, and the second chief cause of spoilage in winter-grown tomatoes in transit from certain other southern States. It is known to develop most rapidly in ripe fruits at about 70° F., and does not spread from diseased to adjacent healthy fruits in packing cases. Stem scars, growth cracks, or mechanical injuries must be present before the fungus can effect an entry but it was observed to occur extensively on the foliage of the winter crop at Homestead, Florida, during seasons of moderate temperature and high humidity. In warm, dry seasons prevalence is much reduced and the damage caused is little or none. Applications (as a rule 8 in number) of Bordeaux mixture (4–4–50), usually with calcium caseinate added, increased the yields of marketable fruit, and prevented the development of a high percentage of infection in stored fruits during seasons favouring the disease, but in warm, dry seasons reduced the yields of marketable fruit. Infection was further reduced by washing the tomatoes immediately after picking with 5 per cent. borax, 1 per cent. sodium hypochlorite, or 1 in 150 sodium polysulphide solution, each with 0·5 per cent. liquid soap as a wetting agent. The borax solution was slightly better than the others. The solution was placed in tubs or barrels at the ends of the rows, and the fruits were dipped before being placed in field boxes for hauling to the packing sheds. Picking the fruit while wet increased infection in storage. Of the varieties tested Livingstone's Globe, Marglobe, and Pritchard were the most resistant to both leaf and fruit infection; in 1935–6 the Rutgers variety was the most resistant to leaf infection.

Fajardo (T. G.). **The Tomato leafmold (Cladosporium fulvum Cke.), a new serious disease of Tomato in Baguio, Mountain Province.**—*Philipp. J. Agric.*, viii, 2, pp. 163–186, 12 pl., 1937.

Field and glasshouse studies carried out in Baguio, Mountain Province, Philippine Islands, on tomato leaf mould (*Cladosporium fulvum*) [*R.A.M.*, xvi, p. 660] showed that at present the disease is confined to the local experiment station where it occurs in the glasshouse and in the field and may cause very serious losses, the climate being ideally favourable to infection. Under the conditions prevailing in the vicinity, the spores germinate readily in the presence of moisture in the glasshouse, laboratory, or open, with and without shade. Tomatoes readily become infected as a result of spraying both sides of the leaves with an aqueous suspension of spores, the symptoms developing in 10 to 15 days. The evidence indicated that the fungus remains viable for 4 to 8 months in the glasshouse. No tomato variety tested was entirely resistant, but the author's selections from Burpee's Self Pruning are recommended for glasshouse culture for the time being in place of the other varieties so far tested.

Rombouts (J.). **Algumas palavras sobre uma molestia cryptogamica, prejudicial aos Tomateiros, na Bahia, causada por 'Septoria lycopersici' Speg.** [A few words concerning a cryptogamic disease of Tomatoes in Bahia, caused by *Septoria lycopersici*, Speg.]—*Rodriguésia,* ii, 8, pp. 45–49, 2 figs., 1937.

The author states that in December, 1936, tomatoes grown at the

General Experimental Station of Agua-Preta, Bahia, Brazil, were practically completely destroyed by attacks of *Septoria lycopersici* [*R.A.M.*, xvi, p. 113, 279, 655], a fungus which is also prevalent in other districts of Brazil. The outbreak at the Station was particularly severe on tomatoes affected with virus diseases, and observations indicated that the fungus developed most vigorously on the chlorotic spots and curled areas of the leaves.

BEST (R. J.). **On the presence of an 'oxidase' in the juice expressed from Tomato plants infected with the virus of Tomato spotted wilt.** —*Aust. J. exp. Biol. med. Sci.*, xv, 3, pp. 191–199, 1937.

The juice expressed from the leaves of Dwarf Champion, Early Dwarf Red, Sensation, and Early Dwarf Red × Break o' Day tomatoes infected by the spotted wilt virus [see above, p. 126] was found to contain an 'oxidase' enzyme, tentatively identified as tyrosinase, which catalyses the oxidation of phenol, catechol, quinol, and tyrosin in the presence of air. The reaction does not proceed to a demonstrable extent in suspensions of juice expressed from the same organs of healthy plants but does so in suspensions of healthy root juice. The enzyme was also present in the juice of Blue Pryor tobacco leaves infected by spotted wilt but not in that of Golden Gleam nasturtium [*Tropaeolum majus*] similarly attacked. The juice of infected field-grown tomato plants was further found to contain an autoxidizable substance, the oxidized form of which was capable of inactivating the virus *in vitro* in suspensions buffered at P_H 7. It was concluded that the rapid oxidation of this autoxidizable substance in air is catalysed by the enzyme and that the oxidized form of the substance inactivates the virus by direct oxidation. A similar explanation is offered in respect of the rapid inactivation of the tomato spotted wilt virus in suspensions containing phenol, catechol, or quinol exposed to air. In the presence of free oxygen the enzyme catalyses the oxidation of the phenols and the oxidation products then inactivate the virus.

The bearing of these data on some plant-virus interrelationships, and on the handling of virus suspensions, is discussed in the light of recent studies by the author [ibid., xvi, p. 778] and others.

FRANSEN (J. J.). **Verslag over de onderzoekingen betreffende Iepenziekte en Iepenspintkevers.** [Report on the investigations relating to Elm disease and Elm bark beetles.]—*Tijdschr. PlZiekt.*, xliii, 9, pp. 195–217, 1937.

The following are among the items of interest in this comprehensive report of recent investigations in Holland on various aspects of the elm disease (*Ceratostomella ulmi*) and the relationship of elm bark beetles (*Scolytus scolytus* and *S. multistriatus*) to its development [*R.A.M.*, xv, p. 126; xvi, p. 844, and next abstracts]. Conflicting results were given by experiments in the inoculation of resistant and susceptible varieties with and without the intervention of the beetles, presumably owing to unfavourable weather conditions for the insects. In one series three resistant varieties, *Ulmus wallichiana* and seedlings 24 and 44, contracted the disease as a sequel to the conveyance of inoculum by the beetles but did not react to direct injections with a spore suspension

of the fungus, while in another even the most susceptible varieties did not become diseased from inoculation by means of the beetles but responded positively to injections.

The following varieties, exposed to natural infection in the field by means of bark beetles, remained healthy in 1933 and 1934: *U. pumila*, *U. foliacea dampieri*, *U. sieboldii*, *U. macrocarpa*, and seedlings 1 and 24; *U. macrocarpa* further maintained its resistance to *C. ulmi* in 1935, when *U. wilsoniana*, which in 1934 exuded extensive quantities of sap, was also not infected. The W1 variety was shown by inoculation experiments in 1935 to be almost as susceptible as the Dutch elm. Some uninoculated trees showing die-back of the crowns in 1934 were found to be infected by *Nectria*, *Phomopsis*, and *Alternaria* spp. and *Papularia sphaerosperma*.

Cases have been observed in which both old and young trees have suddenly succumbed to a recrudescence of infection by *C. ulmi* after a period of abeyance; even such relatively resistant varieties as *U. foliacea dampieri*, *U. foliacea aurea*, and *U. glabra fastigiata* may be affected in this way. Trees have also been found to harbour the fungus for lengthy periods (nine years in one instance) without showing any symptoms of infection.

Discussing the spread of the elm disease in Europe, the writer points out that infection has travelled much more rapidly in an easterly than in a northerly direction. Various theories may be advanced in explanation of this phenomenon, of which the most plausible appears to be based on the scarcity or absence of bark beetles in the northern countries, except Sweden, where several species of *Scolytus* are represented. The disease may gradually extend to the northernmost limit of distribution of the insects.

FRANSEN (J. J.). **De verbreiding van Ceratostomella ulmi (Schwarz) Buisman door den wind.** [The dissemination of *Ceratostomella ulmi* (Schwarz) Buisman by the wind.]—*Tijdschr. PlZiekt.*, xliii, 9, pp. 218–222, 1937.

Full details are given of the writer's experiments, carried out by various methods, including a technique specially devised for the purpose and described at length in *Vakbl. Biol.*, xvii, 1, pp. 7–10, 1935, to determine the part, if any, played by the wind in the dissemination of *Ceratostomella ulmi* [*R.A.M.*, xiv, p. 611 and preceding and next abstracts]. The results of the tests showed that not only the various types of spores of *C. ulmi*, but also its mycelium, are ill adapted to transmission by air currents, the role of which in the spread of the fungus must consequently be regarded as negligible. It is true that the infected dust ejected by the elm bark beetles [*Scolytus scolytus* and *S. multistriatus*] in the course of boring through the cortex may be conveyed by the wind to healthy trees, but in such cases it is the insects that are primarily instrumental in the distribution of the fungus. The beetles not only prepare the pupal chambers in which the coremia of *C. ulmi* are formed but they inflict the wounds through which the fungus gains ingress into healthy trees. In Holland, at any rate, these insects may be regarded as the sole effective means of transmission of the elm disease.

Felt (E. P.). **Balloons as indicators of insect drift and of Dutch Elm disease spread.**—*Bull. Bartlett Tree Res. Lab.* 2, pp. 3–10, 1 map, 1937.

Between 9th May and 23rd July, 1936, 4,935 toy balloons were released with requests to the finders for their return to the Bartlett Tree Research Laboratory, Stamford, Connecticut, with a view to determining the possible implication of wind in the distribution of the Dutch elm disease [*Ceratostomella ulmi*: see preceding and next abstracts]. From the 208 returns it seems evident that the distant spread of the disease from the original focus of infection to the north-east is associated with the conveyance of the bark beetles [*Scolytus scolytus* and *S. multistriatus*], the carriers of the fungus, by the wind.

Goss (Marie C.) & Moses (C. S.). **A bibliography of the Dutch Elm disease.**—61 pp., U.S.D.A., Bur. Pl. Ind., Div. For. Path., 1937. [Mimeographed.]

This bibliography, a revised (to May, 1937) and expanded edition of a similar list published in 1935, comprises 678 titles of papers appearing on the Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*) [see above, pp. 81, 125 and preceding abstracts] in scientific, semi-scientific, and certain popular American and foreign journals.

Mielke (J. L.), Childs (T. W.), & Lachmund (H. G.). **Susceptibility to Cronartium ribicola of the four principal Ribes species found within the commercial range of Pinus monticola.**—*J. agric. Res.*, lv, 5, pp. 317–346, 1 map, 5 graphs, 1937.

A full report is given of studies from 1924 to 1928 in British Columbia and in 1933 and 1934 in the white pine region of northern Idaho to determine the relative importance of *Ribes petiolare*, *R. inerme*, *R. viscosissimum*, and *R. lacustre* [*R.A.M.*, xiv, p. 66; cf. also xvi, p. 74] in the spread of white pine blister rust (*Cronartium ribicola*) in North America, as judged by their susceptibility to infection with the rust and the abundance of teleutosori produced on them. The results of the tests (involving a total of nearly 3,900,000 *Ribes* leaves) were recorded on the lines of a system devised for the needs of the work, and which is fully described. *Ribes* species other than the four named are stated to be seldom met with in the commercial range of the western white pine (*Pinus monticola*) in the United States. *R. petiolare* was found to be highly susceptible, approaching cultivated black currant both in severity of infection and production of teleutosori, while *R. inerme* equalled or even surpassed it from both standpoints when growing in the shade. The other two species are more resistant; *R. lacustre* may occasionally become moderately infected but its production of teleutosori is almost always quite low. The investigations included the open, shade, and part-shade forms of the four species; relative susceptibility of these forms and the ratios of teleutospore production to percentages of leaf surface infected remained fairly constant; weather and other environmental conditions caused, however, marked local and annual differences in the degree of infection between individuals and groups of individuals of the same species and form; there also was evidence of inherent differences in susceptibility between individuals.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*NachrBl. dtsch. PflSchDienst*, ix, 6, p. 135, 1937.

YUGOSLAVIA. A Decree of the Minister of Agriculture, dated 13th January, 1937, prohibits the importation of Douglas fir (*Pseudotsuga douglasii*) [*P. taxifolia*] seedlings with a view to the exclusion from Yugoslavian territory of *Rhabdocline pseudotsugae* [see above, p. 85].

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xi, 9, pp. 202–203, 207, 1937.

AUSTRIA (Confederation). Decree No. 103 of 10th April, 1937, enumerates the following countries as being deemed to be free from potato wart disease (*Synchytrium endobioticum*) and whence fresh tubers may accordingly be imported by rail into the Austrian Confederation: Egypt, French Colonies and Protectorates in North Africa, Italy, Yugoslavia, Malta, Rumania, and Hungary [*R.A.M.*, xv, p. 464].

FRANCE. All dealers in insecticides, fungicides, or plant protectives of any description (except copper products) are obliged, by a Decree of 11th May, 1937, to furnish full particulars of the origin of their products, the contents of which in active elements should be indicated by weight per 100 kg. or l. of the preparation [*R.A.M.*, xiv, p. 814]. The active principles are further to be designated by the names of the basic metals or metalloids in the case of simple or compound preparations, by those of the alkaloid components in organic products, or by the patented name under which the substance is marketed. It is also incumbent upon dealers in this class of goods to supply the Ministry of Agriculture with two copies before publication of all catalogues and prospectuses relative to the sale of such products.

A summary of legislation relating to the introduction of plants into the Colonial Dependencies of the British Empire as at the end of December 1936.—65 pp., London, H.M. Stationery Office, 1937. Price 1s.

The data obtained from the various Colonial Dependencies of the British Empire relative to their plant quarantine regulations, in response to action taken by the Secretary of State at the instance of the Third Imperial Mycological Conference held in London in 1934, is here summarized in a uniform manner and grouped geographically. The information here presented in digest form shows the position as at the end of December, 1936. [The Antigua plant and animal importation restrictions are also summarized on pp. 10–13 of the Report on the Agricultural Department for 1936.]

Service and regulatory announcements April–June 1937.—*S.R.A., B.E.P.Q.* 131, pp. 103–202; U.S. Dep. Agric., 1937.

Summaries are given of the plant quarantine import and transit restrictions in force in Egypt, Austria, Malta, Great Britain, Rumania, Argentina, Montserrat, St. Vincent, Gilbert and Ellice Islands, Barbados, St. Lucia, Northern Rhodesia, Belgium, Greece, Sweden, Seychelles, Fernando Po and Spanish Guinea, British Guiana, French Colony of Algeria, French Zone of Morocco, Central America, Southern Rhodesia, Yugoslavia, Belgian Congo, and Iran (Persia).

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Ritschl (A.). **Untersuchungen über Gloeosporium fagicolum Passerini, den Erreger der Blattfleckenkrankheit der Buche.** [Studies on *Gloeosporium fagicolum* Passerini, the agent of the Beech leaf spot disease.]—*Z. PflKrankh.*, xlvii, 9, pp. 486–491, 5 figs., 1937.

For several years the writer has observed a beech disease occurring at elevations up to 1,000 m. in the Black Forest, chiefly in young stands, and associated with the presence of *Gloeosporium fagicolum*, first reported from Germany by H. Morstatt in 1909 (*Ann. mycol., Berl.*, vii, p. 45). In addition, however, to the irregular, brown, dark-edged lesions characteristic of that fungus, the foliage bore a number of spots along the veins strongly suggestive of those produced by *Gnomonia veneta* on *Platanus* [*R.A.M.*, xiv, p. 203]. The diseased areas frequently spread fanwise towards the leaf tips, being circumscribed laterally by two veins. The necrotic portions of the leaves subsequently fell out or were destroyed by wind or rain. The original centres of infection extended much more rapidly under wet than under dry conditions, and the entry of the fungus was apparently facilitated by the presence of the galls of *Hormomyia piligera*, in and around which stromata, 150 to 220 μ in diameter, were formed in profusion, giving rise in a humid atmosphere to whitish, later pink, tendrils or clusters of elongated, ovoid, biguttulate conidia, 9 to 15 by 4 to 6 μ, germinating in water in three to four hours at 22° C.

Conidia on beer wort agar at 20° to 22° produced white to pink colonies, becoming successively covered with a white stromatic network and a white, flocculent aerial mycelium and gradually developing marked zonations. Conidia were produced by budding from the mycelium and were of a more regular oval and squat shape than the original organs, uni- to biguttulate, with minimum and maximum dimensions of 8·5 by 4 and 10 by 5 μ, respectively. On beech chip decoction nutrient agar, conidia were sparsely formed, being replaced by a branched, radiating, stromatic mycelium from which arose after several months in the laboratory small pycnidium-like protuberances containing numerous regular, oval spores. No conidia developed on rice in test-tubes but brown to black sclerotia were formed, partially discolouring the medium.

Black, spherical pycnidia of the fungus, 185 to 220 μ in diameter, were first observed in nature on leaves collected in the forest on 26th November, 1934, protruding above the epidermis and containing numerous spores, 12·5 by 5 μ, which readily germinated in tap water,

producing a branched mycelium composed of densely interwoven, sheathed hyphae. Spherical perithecia, 125 to 230 by 160 to 250 μ, with beaks averaging 140 to 250 by 30 to 42 μ but attaining up to 600 μ in length, were detected on overwintered leaves in the open at the end of March; they were occupied by a large number of clavate asci, 49 to 56 by 8 to 13 μ, the upper parts of which were furnished with the circular pore characteristic of *Gnomonia*, containing eight elongated-oval, hyaline, uniseptate ascospores, 13 to 15 by 4 to 5 μ, closely resembling those of *G. veneta* and *G. quercina*. Pure cultures of ascospores on beer wort agar gave rise to a white aerial mycelium and slime drops consisting of the typical conidia of *Gloeosporium fagicolum*. Inoculation experiments with ascospores on beech seedlings in pots gave negative results.

It would appear from these researches that *G. fagicolum* represents the imperfect stage of a *Gnomonia* closely allied to *G. quercina*, *G. tiliae* [ibid., xv, p. 74], and *G. veneta* but differing from them in its considerably longer perithecial beak and asci without stalks resembling those of *G. alniella*. The name of *G. fagi* [without a Latin diagnosis] is proposed for the beech leaf spot organism, though it is perhaps scarcely more than a biologic race of the above-mentioned species.

NISIKADO (Y.) & YAMAUTI (K.). **On Neocosmospora vasinfecta Smith, a causal fungus of seedling-wilt of Silk-tree, Albizzia julibrissin Durraz.**—*Ber. Ōhara Inst.*, vii, 4, pp. 549–556, 3 pl., 1937.

A serious wilt disease is stated to have developed recently among nursery seedlings of the silk tree (*Albizzia julibrissin*), which is largely used in the maritime districts of Japan for interplanting with black pines (*Pinus thunbergii*) to prevent the drifting of sand by the wind on to fields of cultivated crops. Infection appears during a dry spell in the middle of June in the form of a sudden wilt and defoliation, followed by the death of the seedlings. In 1935, 99 per cent. of the seedlings in some nurseries near Kanazawa were destroyed by the disease, only 2,000 to 3,000 out of some 200,000 surviving. Diseased roots turn brown and after a few days in a moist chamber become covered with white, later pale yellow to dark brown, guttulate, septate hyphae, 2 to 9 μ in diameter (commonly 4 to 6 μ), interspersed with globose or ovate perithecia, 150 to 340 μ in height (mean 240 μ), 120 to 270 μ in diameter (214 μ), with a coral- to vermilion-red peridium, 20 μ thick, and a neck 30 to 40 or up to 80 μ in length. The fungus was obtained in pure culture and identified, on the basis of comparative studies of the authors' isolations and material supplied by Prof. Johanna Westerdijk, Baarn, Holland, as *Neocosmospora vasinfecta* [*R.A.M.*, xv, p. 778], the distinguishing characters of both organisms being presented in tabular form. The asci of the silk tree strain measure 75 to 130 by 10 to 15 μ, the ascospores 10 to 18 by 7 to 13 μ, the mostly non-, frequently uni-, and rarely biseptate conidia 6 to 14 by 2 to 5, 11 to 36 by 3 to 5, and 21 to 37 by 3 to 5 μ, respectively, and the chlamydospores 5 to 12·5 by 5 to 12 μ (mostly 8·8 by 7·5 μ).

The pathogenicity of *N. vasinfecta* to watermelon, cotton, and other plants has been generally disputed since Butler's report on the parasitism of the fungus (*Mem. Dep. Agric. India*, Bot. Ser., ii, 9, 1910), but in the authors' tests the silk tree strain attacked its own host, watermelon,

and cotton under appropriate conditions [see next abstract], and can therefore no longer be regarded as a pure saprophyte.

NISIKADO (Y.) & YAMAUTI (K.). **Temperature relations to the vegetative and reproductive growth and the pathogenicity of Neocosmospora vasinfecta Smith.**—*Ber. Ōhara Inst.*, vii, 4, pp. 557–572, 1 pl., 1 graph, 1937.

The ascospores of *Neocosmospora vasinfecta*, the agent of seedling wilt of the silk tree (*Albizzia julibrissin*) in Japan [see preceding abstract], began to germinate in the writers' experiments under controlled conditions at 10° to 15° C., the optimum temperature for the process being about 30° and the maximum 38°. The minimum, optimum, and maximum temperatures for mycelial development were 10°, 30°, and 40°, respectively, for conidial growth 10°, 24° to 29°, and 38°, and for perithecial formation 10° to 15°, 27°, and 32° to 35°.

The pathogenicity of the fungus to silk tree, cotton (*Gossypium nanking*), and watermelon seeds and seedlings was demonstrated in seed and soil inoculation experiments at a temperature range of 10° to 35°, infection being more severe about 25° and comparatively slight below 15°. Germination was almost invariably entirely inhibited and the few plants surviving attack in the incipient stages of growth developed wilt later. The definitely non-saprophytic character of *N. vasinfecta* is considered to be amply proved by the results of these tests.

TAMBLYN (N.). **Decay in timber, with special reference to Jarrah.**—*Aust. For. J.*, ii, 1, pp. 6–13, 4 figs., 1937.

Following some general observations on the factors involved in the process of decay in timber, the writer describes some pathological conditions affecting jarrah (*Eucalyptus marginata*), an important commercial hardwood, in Western Australia.

Brown trunk rot (*Polyporus eucalyptorum*) [*R.A.M.*, vii, p. 406], probably the most destructive heart rot of the standing tree, frequently extends for 20 ft. or more through the bole. The decayed wood, in the later and more typical stage of the disease, is abnormally dark, compact but very brittle, and on drying out tends to crack cubically. The annular and radial shrinkage cracks are filled with relatively immense sheets of tough, white mycelium. The sporophores of the fungus often occur high up on the trunk (mostly of living trees) and are characterized by their large dimensions, thick, white, punky flesh, and conspicuous lemon-yellow colour of the pore surface (when fresh). Infection commonly takes place through dead or broken limbs and works downwards. In culture on 2 per cent. malt agar the fungus produces a thick, white, woolly growth, gradually turning greenish-yellow, and chlamydospores in profusion; clamp-connexions were not observed. The optimum temperature for growth in culture was found to be 25° C. *P. eucalyptorum* has also been recorded on various *E.* spp. in New South Wales, Victoria, and South Australia.

Xylostroma heart rot (*P. tumulosus* var. *westraliensis*) has frequently been found vigorously disintegrating old, fallen jarrah logs but was only once isolated from the living tree. The sporophores of the fungus, usually occurring in summer on recently burnt soil, arise from a pseudo-

sclerotium of mycelium-impregnated soil formed in the ground below the log during the process of decay. They are generally solitary, with a short, thick central stipe, a pale tan upper surface, white, punky flesh, and a cream or discoloured pore surface; the caps may measure up to 7 in. in diameter. On 2 per cent. malt agar *P. tumulosus* var. *westraliensis* forms a profuse, white mycelium, numerous clamp-connexions, and a few chlamydospores. Rapid growth is made at the optimum temperatures (about 30° and 25° during the first and second weeks, respectively). Typical decay was induced in moist, sterilized jarrah blocks inoculated with a pure culture of the organism.

Yellow straw butt and trunk rot of mature and over-mature stands of *E. marginata*, *E. staeri* Maiden, *E. jacksoni* Maiden, and (probably) *E. guilfoylei* Maiden, is characterized in the incipient phase by small, bleached, irregular patches of infection, giving the wood a yellow mottled or streaked appearance. As decay advances the rotted areas assume a deep straw colour and stringy consistency. In culture on 2 per cent. malt agar a buff to pinkish-buff aerial mat is formed and fertile pore surfaces of somewhat daedaloid type are often produced after the second week. The globose, hyaline basidiospores average 5·1 by 4·0 μ. Large, simple clamp-connexions develop abundantly, but neither fruit bodies nor chlamydospores have been detected. The optimum temperature for growth in culture was found to be about 30°. Viability was retained for 12 months under dry laboratory conditions.

Black straw rot, though of a much darker colour, is commonly confused with the foregoing on casual inspection, but microscopic examination reveals the presence of an exceptional phenomenon in the form of numerous large bore holes running for long distances down the secondary fibre walls parallel to the long axes of the fibres. A Basidiomycete, constantly associated with this rot, has been isolated but not yet identified. Viability was retained for 12 months in culture.

A white pocket rot, due to a fungus tentatively identified as *Fomes lineato-scaber*, is prevalent as a butt rot of young jarrah coppice growth and also occurs in old logs, stumps, and dead roots. It is characterized by numerous small, irregular, white pockets and streaks of decay, lined with white, delignified fibres and separated by thin areas of apparently sound wood. In older rotted areas the white fibres may disappear from the pockets, which become partly filled with brown mycelium.

A common abnormality of *E. marginata* is 'included sap', which also affects karri (*E. diversicolor*) [ibid., xvi, p. 506], almost invariably in association with the galleries of *Xyleborus truncatus*. In both hosts fungal mycelium has regularly been found in the 'included sapwood' areas, and in the latter species this element is apparently responsible for the non-maturation of the affected wood. On account of the porous nature of 'included sapwood', timber with this defect is unsuitable for pipes or 'tight' cooperage, nor can it be expected to possess the durability in service of normal true wood.

'Pencilled wood', affecting *E. marginata*, *E. jacksoni*, and *E. guilfoylei*, is also of fungal origin, the causal organism being apparently identical with *Fistulina hepatica* [ibid., xvi, p. 4], the sporophores of which are common on jarrah trunks in Western Australia and have also been reported from New South Wales, Victoria, and South Australia.

The appearance of 'pencilled' jarrah differs according to the plane of surface: on a transverse face numerous dark streaks about 1 mm. in thickness occur, radiating outwards for 2 in. or more. Viewed tangentially, the pencilling appears as dark, elongate pockets or streaks running parallel to the direction of the fibres and imparting a speckled aspect to the wood. On a radial longitudinal face the discolorations appear as irregular, dark smudges. The dark coloration is attributable to excessive infiltration of the fibre and vessel lumina with an abnormally heavy, dark deposit of kino [the dark reddish-brown gum of various tropical trees]. *F. hepatica* appears gradually to lose its viability after felling and positive isolations were not made from timber stored for longer than a year. On the other hand, it seems to remain active in the true wood of living trees for many years; isolation presents some difficulty and is best effected from diseased sapwood or newly formed true wood.

LUDBROOK (W. V.). **Needle fusion of species of Pinus in southern New South Wales. Progress report 1933–36.**—*Pamphl. Coun. sci. industr. Res. Aust.* 72, 23 pp., 3 pl., 1937.

In this paper the writer summarizes the information accumulated in the course of investigations from 1933 to 1936 on the 'needle fusion', 'fused needle', or 'curly needle' disease of pines, which is stated to be confined to Australasia and of importance chiefly in Queensland, Tasmania, and the coastal plantations of New South Wales [*R.A.M.*, xiii, p. 553; xvi, p. 234]. In southern New South Wales the needle abnormalities associated with the disturbance commonly appear from three to seven years after the trees have been planted in their permanent positions. In addition to the apparently immune *Pinus pinaster*, *P. caribea* has shown some measure of resistance to needle fusion. Diseased needles were found to be markedly deficient in starch compared with healthy ones. With the doubtful exception of boron none of the soil treatments applied against needle fusion proved effective. The maximum incidence of attack so far recorded in trial plots is 33·3 per cent.

FRACKER (S. B.). **Progress in the control of White Pine blister rust.**—*Science*, N.S., lxxxvi, 2229, pp. 266–267, 1937.

In this account of the control of white pine (*Pinus strobus*) blister rust [*Cronartium ribicola*: *R.A.M.*, xvi, p. 287] in the United States the author states that the protection of valuable stands of five-leafed pines has progressed rapidly, especially since 1933, and excellent advances have been made in the protection of *P. strobus*, *P. monticola*, and *P. lambertiana*, the three commercially valuable species of susceptible pines which cover an area of about 15,000,000 acres of land. The 900 ft. border zones required to be kept free from *Ribes* spp. increase the acreage of control areas to over 26,000,000 acres and of these over 18,000,000 acres had been given one working for the eradication of *Ribes* by the end of 1936. There is some regeneration of *Ribes* after eradication, and parts of the control areas have to be worked over again in from about three to ten years, but working over the area one to three times seems to afford adequate protection to the pines from the seedling stage to maturity.

Acree (Ruby J.) & Goss (W. H.). **A microchemical colorimetric P_H procedure for differentiating the telia of Cronartium ribicola and C. occidentale.**—*J. agric. Res.*, lv, 5, pp. 347–352, 1937.

A description is given of a technique by means of which the authors claim to have demonstrated the presence in the teleuto stages of *Cronartium ribicola* [see preceding abstract] and *C. occidentale* [*R.A.M.*, xiv, p. 377] of a minute physico-chemical difference, which is intensified by treatment with dilute acid, distilled water, and bromphenol blue under P_H control, when *C. ribicola* stains blue and *C. occidentale* green. The definition and consistency of the results obtained is considered to indicate the possibility of rapidly differentiating the two rusts in the teleuto stage even when only small and sparsely infected specimens are available.

Young (H. E.). **The prevention of blue stain in Hoop Pine logs.**—*J. Aust. Inst. agric. Sci.*, iii, 3, pp. 160–162, 1937.

In an experiment carried out in Queensland in which hoop pine (*Araucaria cunninghamii*) logs were sprayed (by means of a knapsack sprayer) with various chemicals (after barking) against blue stain, caused principally by *Diplodia pinea* [*R.A.M.*, xvi, pp. 148, 787] the best control was given by lignasan (ethyl mercury chloride) [ibid., xvi, p. 428] both in the rain-forest and at the loading ramps in the open. No blue stain developed on the lignasan-treated logs for seven weeks, though the condition was clearly apparent in the untreated logs within four weeks of felling. Bordeaux mixture came next in efficiency, followed in order by creosote soap emulsion and 'quartzite' (meta sodium silicate), of which the last gave practically no control. Unbarked logs, the ends of which were sealed with creosote-vaseline paint, remained clean, but became difficult to bark after a few days; this method should, however, ensure the preservation of logs that have to be kept in the forest for some time.

Blue stain developed more rapidly outside the rain-forest than within the timbered area owing doubtless to warmer temperatures and quicker drying. Logs placed on skids in the open were more severely stained than those left on the ground and the upper side of the latter showed more staining than the lower. Some trees showed individual resistance. The sprays, to be effective, had to be applied within 24 hours of felling and barking, and as lignasan did not check borer damage, which causes as much deterioration as staining, the logs must be removed from the stump to the mill with all possible speed. During the eight weeks of the experiment only the sapwood was affected by the staining fungi.

Downey (E. J.). **Open tank creosote treatment of Shortleaf and Loblolly Pine poles.**—*J. For.*, xxxv, 4, pp. 349–352, 2 figs., 1937.

To meet the demands for small telephone poles required by the Texas Forest Service an enlarged open-tank creosoting plant was erected consisting of two rectangular tanks, 3 by 3 by 18 ft., with a space under each for firing and an overhead system of blocks for the manipulation of an entire charge of poles as a unit. For the treatment of the first six charges of shortleaf and loblolly pines (*Pinus echinata* and *P. taeda*, respectively), the hot vat was kept at about 190° F., while the cold one

was allowed to remain at air temperature (average 90°). After two hours in the hot vat the charge was rapidly transferred to the cold one and left submerged for two hours at 90° to 100°. This treatment gave excellent penetration of creosote, averaging 2 in. at 2 ft. from the butt end of the pole, but the amount used (18 to 20 lb. per cu. ft.) was regarded as excessive for the type of material employed and extensive loss of creosote occurred through 'bleeding' [*R.A.M.*, xvi, p. 79]. By treating the poles for one hour in the hot vat at 220° to 225°, then transferring them to the cold one at about 100° for 1 to 1½ hours, and subsequently returning them to the hot vat for 30 minutes at 225° [cf. ibid., xvi, p. 429] the retention of creosote was reduced to 12·8 lb. per cu. ft., and 'bleeding' was entirely prevented, while the average penetration obtained was 1·83 in.

Desch (H. E.). **Sapwood versus heartwood.**—*Builder, Lond.*, clii, 4915, p. 842, 1937.

Referring to the discrimination against the use of sapwood which is stated to be a common feature of timber specifications in building contracts, the writer points out that sapwood presents no attractions to the agents of decay when sufficiently seasoned, i.e., to a state in which it contains less than 25 (or to be absolutely safe, 20) per cent. of its dry weight of water. Properly seasoned joinery in a well-ventilated building should contain 10 to 15 per cent. moisture, basement and ground-floor joists and roofing timbers 18 to 22 per cent. In this connexion it may be mentioned that the common clause insisting on a bright, clear condition of such sapwood as is permitted is superfluous, since the dullness due to blue stain [*Ceratostomella* or *Ophiostoma* spp. and other fungi, see next abstract] does not involve any reduction of strength.

Greaves (C.). **Chemicals in wood preservation.**—*Canad. Chem. Metall.*, xxi, 9, pp. 301–304, 1937.

This is a useful survey of some outstanding recent investigations [reference to which has been made at intervals in this *Review*] on various aspects of wood preservation, including the nature of the substances used for this purpose, the mechanism of injection, methods of testing the permanence and toxicity of preservatives, the variable character of creosotes, creosote specifications [*R.A.M.*, xvi, p. 788], high and low residue creosotes, and modern developments in wood preservation.

Howitt (J. E.), Sands (D. R.), & Beck (E. C.). **Diseases of vegetables.** —*Bull. Ont. agric. Coll.* 386, 70 pp., 33 figs., 1937.

Popular descriptions are given of the symptoms of a number of well-known fungous, bacterial, and virus diseases affecting vegetables in Ontario, with observations on their etiology and directions for control.

Tompkins (C. M.), Gardner (M. W.), & Thomas (H. R.). **Black ring, a virosis of Cabbage and other crucifers.**—Abs. in *Phytopathology*, xxvii, 9, pp. 955–956, 1937.

Black ring, a virus disease of cabbage, occurs during the cool weather in the San Francisco Bay region and elsewhere in California. In the

early stages the numerous chlorotic rings formed on the leaves collectively induce chlorosis, followed by blackening and necrosis of the affected tissues. In the field only older leaves show black ring symptoms, which are most conspicuous on the dorsal surface, but in the greenhouse systemic infection of healthy seedlings was obtained in 9 to 21 days by rubbing the foliage with expressed juice and carborundum. The insect vectors, which breed naturally on the host, are the cabbage and green peach aphids [*Brevicoryne brassicae* and *Myzus persicae*, respectively]. The virus succumbs to ten minutes' heating at 59° C., three days' ageing at 22°, and diluting 1 to 1,000. All commercial varieties of cabbage appear to be susceptible, and infection was further obtained on rhubarb, *Chenopodium album*, *C. murale*, spinach, *Stellaria media*, *Brassica arvensis*, kale, Brussels sprouts, cauliflower, broccoli, kohlrabi, swede, turnip, wallflower, Brompton and annual stocks [*Matthiola incana* and its var. *annua*, respectively], dame's violet [*Hesperis matronalis*], Virginian stock [*Malcomia maritima*], watercress, honesty [*Lunaria annua*], Chinese radish, Turkish and White Burley tobacco, and *Nicotiana glutinosa*. The disease is similar to the cabbage ring spot described by K. M. Smith in England in 1935 [*R.A.M.*, xv, p. 97].

Woodcock (J. W.) & Merry (D. M.). **Control of brown-heart in Swedes.**—*N.Z. J. Agric.*, lv, 3, pp. 151–154, 1937.

In 35 field trials carried out in New Zealand to ascertain the effect of borax on the control of brown heart of swedes [*R.A.M.*, xvi, p. 722], the borax was mixed and drilled along with the fertilizer and seed, at rates of 3, 6, 9, and 12 lb. per acre, or broadcast before or immediately after drilling, a few broadcast applications being made, in addition to the dressings given at seeding, at thinning, and when the crop was half-grown.

Mixing the borax with fertilizer and sowing in intimate contact with the seed in some cases adversely affected the seedlings, even at the lowest rate of application, though broadcasting at 10 lb. per acre before sowing was not injurious. Satisfactory control was obtained in all but six tests. When the borax was drilled, applications of 3 lb. or more per acre gave a high degree of control (70 per cent. or more reduction in incidence) in seven tests, while in three the lowest amount required to effect this reduction was 6 lb., and in seven 9 to 12 lb. per acre. In one experiment, in which applications of 3 and 6 lb. per acre were only slightly effective, an application of 10 lb. of borax broadcast before sowing was as satisfactory as 9 and 12 lb. applied in close proximity to the seed. Broadcasting at thinning appeared to be as effective as broadcasting before seeding, but when applied about half-way through the growing period borax was generally less effective. The addition of lime to borated mixtures had no effect on control.

It is recommended that the borax should be broadcast (with sawdust or soil to facilitate distribution) before or shortly after sowing at rates ranging from 10 to 20 lb. per acre. If top-dressing is impracticable drilling at 3 to 6 lb. per acre is likely to give fair control without too much injury, which is further reduced by sowing the crop in 7 in. drills or putting one half of the borated fertilizer below and one half with the seed.

Le Clerg (E. L.). **Relative efficiency of randomized-block and split-plot designs of experiments concerned with damping-off data for Sugar Beets.**—*Phytopathology*, xxvii, 9, pp. 942–945, 1 diag., 1937.

In the split-plot type of experimental design proposed by Yates (*J. agric. Sci.*, xxiii, p. 108, 1933; *J.R. statist. Soc., Suppl.* 2, p. 181, 1935), one half of each plot receives a different treatment from the other half, this difference being superimposed on the main treatment. In this paper the writer describes experiments in Minnesota to determine the relative efficacy of this arrangement and that of randomized blocks for the collection of statistical data in field and greenhouse tests on sugar beet damping-off [*Corticium solani*, *Phoma betae*, and *Pythium de Baryanum*: *R.A.M.*, xiii, p. 611; and next abstract]. In 1936 the split-plot design was 71 per cent. more efficient in the field at St. Paul and 53 per cent. more at Waseca than the randomized-block arrangement. In greenhouse tests in 1933 the variance for the former method on a concrete bed and broad-wall bench, respectively, was 146·14 and 194·61 compared with 153·46 and 211·33, respectively, for the latter. Soil-borne pathogens were also shown by these experiments to be unequally distributed in the field.

Le Clerg (E. L.). **Treatment of Sugar-Beet seed increases stand and yield.**—*Circ. Minn. Coll. Agric. Ext.* 57, 7 pp., 2 figs., 1937.

Damping-off of sugar beet seedlings, a destructive disease in early plantings on moist soils in Minnesota [see preceding abstract], is caused by a number of fungi which are most active in stands immediately following lucerne or sweet clover [*Melilotus alba*] and usually less in evidence after maize. In a series of tests from 1933–5 on the control of the disease by seed treatment, the average number of seedlings before thinning in 100 ft. of row was 1,119 in the ceresan-treated plots compared with 653 in the non-disinfected controls. In 1935, 20 growers were each sent a 25 lb. lot of treated seed to be planted under identical conditions with untreated material of the same variety. In four fields in which counts were made before thinning the average increase in stand due to seed treatment was 29·2 per cent. In three fields in 1936 the average increase from treatment amounted to 86·4 per cent. before thinning and 31·3 per cent. at harvest, while the yield of the treated plants was increased on the average by 1·6 tons per acre or 17 per cent. [This article is reprinted in *Agric. News Lett.*, v, 11, pp. 192–195, 1937.]

Lackey (C. F.). **Restoration of virulence of attenuated curly top virus by passage through susceptible plants.**—*J. agric. Res.*, lv, 6, pp. 453–460, 3 figs., 3 graphs, 1937.

Details are given of two years' experiments, the results of which showed that the virulence of the beet curly top virus [*R.A.M.*, xvii, p. 90] attenuated by passage through *Chenopodium murale* [ibid., xi, p. 688] may occasionally be restored to approximately the same potency as that of the original virus by one passage through sugar beet seedlings at the cotyledonary stage; in two cases only it was also restored by passage through seedlings at the two-leaf stage, but never through older plants. There was some evidence of individual variations in the susceptibility of the sugar beet plants tested to inoculations with

either the original virulent or the restored curly top virus, as manifested by the appearance of mild symptoms in a few of the plants inoculated. Passage through alfilaria (*Erodium cicutarium*) and peppergrass (*Lepidium nitidum*), two important wild overwintering hosts for both the curly top virus and its insect vector (*Eutettix tenellus*), was experimentally shown also to be occasionally capable of restoring the virulence of the attenuated virus.

TSUI (P. T.) & LIN (C.). **Experiments on the effect of spraying fungicide to control Broad Bean rust.**—*Ent. & Phytopath., Hangchow,* v, 24–25, pp. 491–495, 1937. [Chinese, with English summary.]

Satisfactory control of broad bean rust (*Uromyces fabae*) [*R.A.M.*, xvi, p. 207], one of the most serious diseases in the Hangchow district of China from the middle of March to the first week of May, has been obtained by weekly applications, from before flowering to harvest, of 0·6 per cent. Bordeaux mixture.

MCWHORTER (F. P.) & PRYOR (J.). **Onion mildew in Oregon and the advisability of testing malachite green as a control agent for downy mildews.**—*Plant Dis. Reptr,* xxi, 16, pp. 306–307, 1937. [Mimeographed.]

Tests on the control of onion mildew (*Peronospora destructor*) [*P. schleideniana*] in the Willamette Valley, Oregon, where the crop is grown on a commercial scale for seed, gave very promising results in respect of combinations of malachite green [*R.A.M.*, xvi, pp. 14, 468] and bentonite [ibid., xvi, pp. 190, 477, 765] or red copper oxide [ibid., xvi, pp. 659, 720]. Malachite green has also been found to be very toxic to *P. pisi* [ibid., xvi, p. 298]. The dye is effective at very high dilutions but on account of its cheapness may be used at concentrations of 1 in 5,000 or less. Further trials on the efficacy of the dye against other downy mildews are advocated.

WIANT (J. S.). **Investigations of the market diseases of Cantaloups and Honey Dew and Honey Ball Melons.**—*Tech. Bull. U.S. Dep. Agric.* 573, 47 pp., 21 pl., 16 graphs, 1937.

Studies [which are fully described] on diseases of melons arriving at New York market, carried out from August, 1931, to the end of 1935, showed that *Fusarium* rot attacks cantaloupes and Honey Dew and Honey Ball melons, and is one of the chief causes (as stem-end rot) of decay in South American Honey Dew melons. The following species were isolated from diseased material: *F. graminum*, *F. semitectum* and its var. *majus*, *F. equiseti* and its var. *bullatum*, *F. scirpi* and its vars. *acuminatum* and *compactum*, a fungus designated *F.* 197–2, *F. culmorum*, *F. moniliforme* [*Gibberella fujikuroi*] var. *subglutinans*, and *F. solani*. Of the 34 isolates, 21 fell within the limits of *F. semitectum* and *F. scirpi*. The symptoms produced by the different species are almost identical, except that *F. graminum*, *F. scirpi* var. *acuminatum*, *F. culmorum*, and *G. fujikuroi* var. *subglutinans* give a reddish or purplish discoloration. On cantaloupes the remaining fungi produce lesions scattered over the surface, on the stem scar, along the sides, or at the blossom end. At first the lesion is almost imperceptible. The infected tissue usually

extends from $\frac{1}{4}$ to $\frac{3}{4}$ in. beneath the rind and is sharply delimited from the healthy part. *F. semitectum* and its var. *majus*, *F. equiseti* and its var. *bullatum*, *F. scirpi* and its var. *compactum*, *F.* 197–2, and *G. fujikuroi* var. *subglutinans* made optimum growth at 80° F., very little or none at 95° in five days, and none at 37° in the same period, though all except *F. scirpi* var. *compactum* and *F. equiseti* showed a trace of growth at 37° in three weeks. *F. culmorum* made the most rapid growth [*R.A.M.*, xvi, p. 806]; its optimum growth temperature was 75°, and it made some growth at 37° in 11 days. *F. scirpi* var. *acuminatum* and *F. graminum* showed optimum growth at 75°, with definite growth at 95° in five days, growth declining at temperatures progressively below 70° until at 37° *F. graminum* showed only a trace of growth and *F. scirpi* var. *acuminatum* none in five days. *F. solani* made optimum growth at 85°, no growth occurring in five days at 105°. Artificial inoculations of Honey Dew and cantaloupe melons with *F. semitectum*, *F. scirpi* and its vars. *compactum* and *acuminatum*, and *F.* 197–2 gave about equal rates of decay, the average diameter of the lesions after one week at 65°, two weeks at 55°, and three weeks at 45° not exceeding 16, 17, and 10 mm. respectively. Only *F. scirpi* var. *acuminatum* gave a trace of decay at 35° after two weeks. Rupture of the skin was essential for infection. The stem-end rot may prove controllable by fungicidal applications to the cut stems.

Rhizopus soft rot was found on cantaloupe and Honey Ball and Honey Dew melons, the first symptom on the last two being a water-soaked, soft, well-defined spot, the advancing margins of which generally remained distinct. On cantaloupes the water-soaking was less evident. No mould grew on unbroken skin. When pressed with the fingers the disease area was wet and felty. Of 37 isolates 16 belonged to the low-temperature group of *Rhizopus* (including *R. nigricans*) [ibid., ii, p. 564] and 14 of these had an optimum growth temperature of 80°. Twenty-one isolates belonged to the intermediate temperature group and had an optimum growth temperature of 90° or 95°. None of the fungi was able to penetrate unbroken skin. Decay by the low temperature group developed best at 80°, and none occurred in three days at or below 50°, or at or above 95°. The optimum temperature for decay by the intermediate temperature group was 90°, the rate falling off rapidly above 100°, none occurring in 3 days at 110° or at 50°. Transit temperatures of 40° to 45° are recommended.

Alternaria rot appears on Honey Ball and Honey Dew melons as small, circular to oval, brownish spots, with regular, definite edges enlarging up to $2\frac{1}{2}$ in. in diameter, sometimes coalescing, and occasionally occurring on the sides. Decay is often largely confined to the rind, which may be dry and papery, or tough and parchment-like. In 21 representative isolates, all of which fell into the *A. tenuis* or *A. brassicae microspora* (Berk.) Sacc. groups of Elliott [*Amer. J. Bot.*, iv, pp. 439–476, 1917] the spores ranged from 10 by 8 to 60 by 22 (average 25·4 by 11·9) μ. The optimum growth temperature of 5 representative isolates lay between 75° and 80°; decay fell off below 70° and ceased at 37°. Transit temperatures of 40° to 45° are recommended.

Cladosporium rot (*C. cucumerinum*) [ibid., viii, p. 626; xi, p. 690; xvi, p. 655] frequently covers the stem scar of cantaloupes arriving at

New York from western States. In the early stages the deep olive growth is superficial but later it turns almost black and causes a shallow decay of the tissues. Honey Ball and Honey Dew melons are also affected. Observations in storage rooms indicated that rotting occurred after one week at 40° to 42° and after ten weeks at 32° to 34°. Control depends on prompt handling and maintenance at temperatures under 40°. Under unfavourable temperature conditions infection is favoured by the use of wrappers.

Phytophthora rot of Honey Dew melons [cf. ibid., viii, p. 353 and cf. next abstract] is ordinarily of minor importance but under certain conditions it may cause almost the entire loss of the carload. At low temperatures the rot appears as circular to oval spots 1 to 4 in. in diameter, and sometimes coalescing, over which the skin may be slightly depressed to sunken. On pale melons the lesions scarcely change colour, while on darker ones they become cartridge-buff, cream, or cream-buff. Later, the lesions are extensive, indefinite, and irregular. The diseased tissues become spongy or leathery, creased, and wrinkled; the epidermis becomes loose, blisters, and is easily rubbed or peeled off. Inoculations of Honey Dew melons with a number of isolates differing in cultural and morphological characters gave identical symptoms, but the specific identity of the causal organism or organisms remains undetermined. With one isolate the optimum temperature for decay was 80°; of the others, half made best growth at 80° and half at 85°. Prevention consists in keeping the melons at 50° or under.

Charcoal rot (*Rhizoctonia bataticola*) (one isolate of which formed pycnidia similar to those of *Macrophomina phaseoli*) [see above, p. 115] causes 1 to 5 per cent. loss in every cargo of Honey Dew melons reaching New York from Chile. The first symptom is a faint, dark water-soaking of the skin. After 5 days at 85° the lesions are about 3 in. in diameter, firm, irregular, indefinite, and often spreading more rapidly equatorially than towards the stem and blossom ends. The lesions are vinaceous-drab, slate-purple, or light vinaceous-purple, the colour varying with different melons and with the progress of the decay; different colours may also be present in the same lesion. The centre of the lesion turns light mouse-grey and is covered with greyish mycelium. The epidermis becomes encrusted with black sclerotia, the skin wrinkles, and the affected areas become less firm and generally depressed. Beyond this area extends a wide band of diseased, firm, smooth, mouse-grey tissue in which the skin becomes water-soaked under pressure and can readily be slipped off. The whole melon becomes affected. The fungus was unable to penetrate the unbroken skin of Honey Dew melons and infection could be almost eliminated by careful handling and transit at under 50°.

Diplodia natalensis rot occurs regularly on Chilian Honey Dew melons. The disease, which is of minor importance, requires skin breaks of some kind for entry of the fungus and would be practically eliminated by transit at under 50°.

Pink mould (*Cephalothecium* [*Trichothecium*] *roseum*) [ibid., ix, p. 531] is important only on South American Honey Dew melons. In cantaloupes the chief diagnostic character is a pronounced bitter flavour. On Honey Dew melons extensive lesions may develop on the

sides or stem end, or small, more definite, lesions may form on the sides. The affected rind is clay-colour, tawny-olive, ochraceous-tawny or buckthorn- to Dresden-brown. The diseased flesh is slightly discoloured brown, not sharply delimited, and is extremely bitter. Transit at temperatures under 40° should control the condition.

The paper concludes with notes on bacterial soft rot [organisms unidentified], *Colletotrichum lagenarium* [ibid., xvi, p. 793], blue mould (*Penicillium* spp.), and minor decays caused by *Mucor* sp., *Aspergillus* sp., *Botrytis cinerea*, and *Monilia sitophila*.

KREUTZER (W. A.). **A Phytophthora rot of Cucumber fruit.**—Abs. in *Phytopathology*, xxvii, 9, p. 955, 1937.

A species of *Phytophthora* was collected in the autumn of 1936 from rotting cucumber fruits in a field in the Rocky Ford district [of Colorado], where 100 per cent. infection occurred. After 6 months in culture the fungus had formed no reproductive bodies but a close relationship to *P. capsici* [*R.A.M.*, xvi, pp. 159, 793, and cf. preceding abstract] is indicated. In inoculation tests it was pathogenic to cucumber, Hubbard squash, and red and green bell pepper [*Capsicum annuum* or *C. frutescens*] fruits, and caused severe damping-off of cucumber and pepper seedlings. Ten to twenty days after the introduction of the fungus into soil in which mature peppers were growing, the plants developed a severe blight.

JAGGER (I. C.) & SCOTT (G. W.). **Development of powdery mildew resistant Cantaloup No. 45.**—*Circ. U.S. Dep. Agric.* 441, 5 pp., 4 figs., 1937.

An account is given of the breeding, characteristics, adaptation, and dissemination of the strain of cantaloupe melon (*Cucumis melo*) known as No. 45 which has been developed in California for resistance to powdery mildew (*Erysiphe cichoracearum*) [*R.A.M.*, xvii, p. 125]. The strain originated from a resistant plant in a variety from India crossed with Hale Best in 1928 and resistance was inherited as a simple Mendelian dominant factor. It is stated that this melon is generally completely free from the disease in the Imperial Valley, while in the coastal regions of California, where conditions are very favourable to infection, it usually shows some mildew late in the season, but not enough to cause appreciable injury to the crop.

CRISTINZIO (M.). **Un grave attacco di mosaico nella Zucca.** [A serious attack of Vegetable Marrow mosaic.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), vi, pp. 95–102, 2 pl., 1937.

In April, 1937, vegetable marrows in the vicinity of Naples were extensively attacked by mosaic [*R.A.M.*, xiv, p. 489], some fields showing up to 90 per cent. infection. *Aphis gossypii* was present in abundance, particularly on the affected plants, which showed characteristic symptoms on the young fruits and leaves [loc. cit.] and, occasionally, on the leaf stalks and male flowers. Control consists in the use of resistant varieties, the destruction of infected plants, seed disinfection, and insecticidal treatments.

Clara (F. M.). **Culture of edible Mushrooms in the Philippines.**—*Philipp. J. Agric.*, viii, 2, pp. 225–231, 4 pl., 1937.

Directions are given for the cultivation of edible mushrooms of the *Volvaria esculenta* [*R.A.M.*, xv, p. 422] type under the conditions prevailing in the Philippine Islands. It is pointed out that abacá [*Musa textilis*] fibre refuse, banana stalks, tobacco midribs, old gunny sacks, and abacá mat trimmings may be used as layers for spawning or mixed with rice straw for making the beds.

Trotter (A.). **I trattamenti polverulenti contro la Peronospora della Vite.** [Dust treatments against Vine mildew.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno (Portici)*, vi, pp. 108–110, 2 pl., 1937.

The author points out that many Italian growers place too much reliance on the number of spray applications made against vine mildew [*Plasmopara viticola*] and fail to realize that dusting is an indispensable part of any control schedule, especially against infection of the fruit clusters under the climatic conditions prevailing in south Italy, where the disease is liable entirely to destroy the bunches. Fluids cannot adequately reach or adhere to the berries and, in particular, they fail to pass between the berries and between the flowers, with the result that they do not reach the most common path of infection. Fine ventilated sulphur or cupric sulphur, if of the best quality and properly applied, covers the whole plant uniformly, penetrating rapidly into the innermost parts of the fruit clusters, and is therefore not likely to be washed off by rain. Three dust applications (in addition to the usual sprays) are essential, i.e., before flowering, after flowering, and when necessary to protect the leaves against late infections. These applications also protect the vines against *Oidium* [*Uncinula necator*].

Jenny (J.). **Eine moderne stationäre Spritzanlage mit elektr. Antrieb.** [An up-to-date stationary spraying plant worked by electricity.] —*Schweiz. Z. Obst- u. Weinb.*, xlvi, 14, pp. 229–232, 2 figs., 1 diag., 1937.

Technical details are given of the installation, construction, and application of a stationary spraying electromotor plant recently erected by the Swiss Federal Experiment Station for Fruit-Growing, Viticulture, and Horticulture at Wädenswil for the control of downy mildew [*Plasmopara viticola*] in a 2-hect. vineyard.

Kordes (H.). **Nekrosen, frühzeitige Blattverfärbungen und Wachstumsstörungen an Reben infolge abnormer Bodenversäuerung.** [Necroses, premature leaf discolorations, and growth disturbances in Vines in consequence of abnormal soil acidification.]—*Wein u. Rebe*, xix, 5, pp. 138–146, 11 pl., 1937. [Abs. in *Neuheiten PflSch.*, xxx, 6, p. 272, 1937.]

Vines in the Palatinate uplands suffer from a disorder expressed by a blackening of the shoots suggestive of infection by a Dematiaceous fungus, subepidermal necroses due to gumming of the disintegrating cell contents, a yellowish-brown discoloration of the leaves, starting at the margins, from June onwards, and by the grapes turning purplish

(instead of the normal golden-yellow) and bursting. Portuguese varieties do not show the foregoing symptoms but are characterized by a reddish tinting of the foliage, described by Zschokke in 1931 as 'sun scorch'. The disturbances in question are attributed to the unduly acid reaction of the local soils (under P_H 4), which may be counteracted by the application of lime at the rate of 5,000 to 6,000 kg. per hect. and incorporation of compost, stable manure, and other fertilizers.

VIVET (E.). **Le court-noué de la Vigne.** [Court-noué of the Vine.]—*Bull. Soc. Agric. Algérie*, lxxx, 498, pp. 73–76, 1937.

In Algeria court-noué of the vine [*R.A.M.*, xvii, p. 95] is prevalent in the sandy soils of the Dahra and various types of silicious soil in the plain of Oran and in the west of the country. Five years ago the disease made its appearance on Carignan vines grafted on Rupestris in the clay soils of the central part of the Soummam Valley, and since then it has spread rapidly, especially in vineyards that have been regularly irrigated three or four times annually for the last 25 years. The disease is most severe on the Aramon variety, followed by Carignan, Cinsault, and Mourvèdre, Chasselas being comparatively resistant. Among the stocks employed locally for grafting, Rupestris du Lot and 3·309 are the most susceptible, while 420 A is not much more resistant; 41 B withstands the disease somewhat better. Under Algerian conditions the association of *Pumilus medullae* [ibid., xvi, p. 587] or other fungi with court-noué is exceptional.

RAVIKOVITCH (S.) & BIDNER (N.). **The deterioration of Grape-Vines in saline soils.**—*Emp. J. exp. Agric.*, v, 19, pp. 197–203, 2 pl., 1 graph, 1937.

In 1934 nine-year-old Chasselas and Muscat Hamburg grape vines growing in clay soil in Palestine began to deteriorate and die as a result of high concentrations of chlorine as sodium chloride developing in the soil following several years of improper irrigation. The affected vines shed their leaves excessively, the berries remained small and shrivelled up, and the branches withered. The tips of the leaves turned yellow and brown spots appeared all over the blades. On badly deteriorated vines the leaves crumbled away. The tips of the shoots became shrunken and dark brown, and died. Analytical data [which are given in full] show that the percentage of sodium chloride in grapes varied from 0·15 (healthy Muscat Hamburg) to 2·47 (severely affected Chasselas) and that of chlorine in the leaves from 0·04 to 3·35, respectively.

WICKENS (G. M.). **Report of the Division of Plant Pathology for the year ending 31st December, 1936.**—*Rhod. agric. J.*, xxxiv, 9, pp. 689–696, 1937.

The following items occur in this report. Symptoms on tobacco, simulating 'kromnek' [*R.A.M.*, xvi, p. 367], in the form of necrosis of the midribs and veins and extensive puckering of the leaf blades, were observed locally, and are believed to have been caused by lightning. On a farm in the Macheke region a severe outbreak occurred of tobacco wilt, isolations from which yielded an organism apparently identical with *Bacterium solanacearum*, but the identity of which needs further confirmation. A condition of maize, similar in its symptoms to the

Florida 'white bud' [ibid., xv, p. 730] and characterized by the fact that newly developing leaves are almost pure white, was fairly prevalent in the Mazoe valley. The occurrence of maize streak [ibid., xv, p. 704] was confirmed by inoculation experiments with the leafhopper (*Cicadulina mbila*). Further work showed that the disease is transmissible by the insect to *Rottboellia exaltata* [ibid., xi, p. 67] and vice versa, indicating that this grass can carry the streak virus from season to season. Similar symptoms were observed on Rhodes grass (*Chloris gayana*) and rapoko grass (*Eleusine indica*).

Young tung oil [*Aleurites fordii*] trees showed a stunting of growth and foliar bronzing, similar to that described from Florida [ibid., xiv, p. 481].

The increasing prevalence of potato common scab [*Actinomyces scabies*] is believed to be in part attributable to the importation of infected seed tubers and it is suggested that it may be checked by only allowing the introduction of certified seed. Internal brown fleck [ibid., xvi, p. 629] is also common, and it is considered that the prevalence of this trouble and of common scab is largely attributable to the practice of growing potatoes in soil deficient in humus.

During the year under review new disease records included root rot of apricot due to *Armillaria* [*mellea*], a dark brown rot of banana stem and pseudostem associated with *Macrophomina phaseoli* [ibid., xiii, p. 494], anthracnose of antirrhinum (*Colletotrichum antirrhini*), leaf spot of cowpea (*Septoria vignae*), green ear disease of *Pennisetum spicatum* (*Sclerospora graminicola*), [ibid., xvi, p. 527], and anthracnose of egg-plant (*C. atramentarium*) [ibid., xvii, p. 60].

Storey (H. H.). **Report of the Plant Pathologist.** *Rep. E. Afr. agric. Res. Sta., 1936–37*, pp. 17–20, 1937.

In this report [cf. *R.A.M.*, xvi, p. 87] the author states that whereas his earlier studies had shown that the power to transmit the maize streak virus was inherited by the vector *Cicadulina mbila* as a dominant Mendelian factor linked with sex, studies with *C. zeae* and *C. storeyi* (referred to as *C. nicholsi* in the last report) revealed anomalous behaviour apparently inexplicable on this hypothesis, similar anomalous behaviour also being observed on the part of certain lines of *C. mbila*. Active individuals of *C. mbila* vary widely in their efficiency as vectors of maize streak, both in the frequency with which they infect plants during short contacts and also in the length of time that they remain infective after removal from a diseased plant. It may be supposed that the former character depends on the rate of output of virus by the insect while being tested and the latter on the ability of the insect to put out virus without replenishing its stock by feeding on a diseased plant, i.e., on the capacity of the insect to permit multiplication of the virus within its body.

Studies made to determine whether variability in these two respects is genetically determined gave inconclusive results as regards the first but demonstrated that the second type of variability is certainly controlled by genetical factors. Beginning with insects having a very low capacity to remain infective, families were bred and tested up to the eighth generation. From an early stage they showed proportions of

active and inactive individuals that could not be fitted into the scheme of inheritance previously established. The results suggested an explanation on the basis of a second genetic factor modifying the dominance of the factor for activity: in certain combinations the modifying factor might prevent the manifestation of activity in an insect carrying the dominant factor for activity, while in others activity might be only weakly manifested. While much of the evidence supports this hypothesis some appears to conflict with it.

A satisfactory technique has now been devised for the artificial transmission of the cassava mosaic [ibid., xvii, p. 94] virus by whitefly (*Bemisia* sp.). Marked seasonal differences in the rate of secondary spread were noted.

DEIGHTON (F. C.). **Mycological work.**—*Rep. Dep. Agric. S. Leone, 1936*, pp. 44–46, 1937.

This report [cf. *R.A.M.*, xv, p. 778] contains, *inter alia*, the following items of interest. In 1936 at Njala eradication measures against citrus scab [*Elsinoe fawcetti*] succeeded in reducing the number of scabbed citrus trees to under 50 and there is every hope that the disease will be completely eradicated in a year or two. A few more cases of psorosis [ibid., xvii, p. 106] appeared in the sweet orange plot at Njala and the affected plants were destroyed. Citrus canker [*Pseudomonas citri*] has not yet been found in the Colony. Foot rot, possibly caused by *Phytophthora*, was noticed on tangerines at Songo. Pineapples at Newton and Njala were severely attacked by a disease associated with an Asterinaceous fungus which has not yet been identified, but is distinct from *Asterinella stuhlmannii* [ibid., vi, p. 341]. The disease is characterized by brown spots, soon becoming sunken in the centre, which turns grey-brown; linear ascomata, 85 to 425 by 85 μ, opening by a longitudinal slit, appear on the surface when the spots are about 1 cm. in diameter. At Njala in its later stages the disease showed a brown streak some 3 cm. wide down the centre of the leaf; at Newton the spots were confined to the apical half of the leaf which after shrivelling became covered with ascomata. The most susceptible variety of pineapple proved to be Red Spanish, Queen and Smooth Cayenne being moderately resistant, and Baronne de Rothschild almost immune. *Rhizoctonia* [*Corticium*] *solani* was recorded for the first time on *Adenanthera pavonia* seedlings, *Piper nigrum*, and eggplant. The following fungi are also newly recorded: *Cercospora hibisci* on *Hibiscus esculentus*, *Fusarium semitectum* var. *majus* on fruit of eggplant, *Pleocyta sacchari* on sugarcane, *Eriothyrium coccicolum* and *Septobasidium pilosum* [ibid., ix, p. 562] on *Lepidosaphes beckii* on grapefruit, *Hymenopsis* sp., *S. lepidosaphis*, and *Tubercularia coccicola* [ibid., xiii, p. 90] on *L. beckii*, *Chionaspis citri* on grapefruit, and *Aschersonia placenta* and *Aegerita webberi* on scale insects on a forest climber.

VAN DER GOOT (P.). **Ziekten en plagen der cultuurgewassen in Nederlandsch-Indië in 1936.** [Diseases and pests of cultivated crops in the Dutch East Indies in 1936.]—*Meded. Inst. PlZiekt., Batavia*, 89, vii×104 pp., 1937.

Among the numerous records of interest in this report, prepared on

the usual lines [cf. *R.A.M.*, xvi, p. 160], the following may be mentioned. Potatoes continued to suffer heavy damage from slime disease [*Bacterium solanacearum*: ibid., xvii, p. 60], which was observed in the Kedoe Residency, Java, to be more virulent on Eigenheimers than on Paul Kruger [President], Inel, and Bandoeng. In the Manado Residency (Celebes), production fell by some 40 per cent. as a result of the disease. The most extensive losses, however, were caused by *Phytophthora infestans* [loc. cit.], which occurred in a devastating form in the Priangan and Buitenzorg Residencies, Java, the reduction in value of the crop in the former amounting to Fl. 140,000.

With the extended cultivation of the resistant Schwarz 21 variety, the ravages caused by *Bact. solanacearum* in groundnut plantations are gradually decreasing, though considerable damage was reported from a number of districts. The same organism attacked cassava in Buitenzorg and Cheribon.

Citrons and other kinds of citrus in Batavia were attacked by the *Fusarium* stage of *Nectria haematococca* [ibid., xv, p. 498], which sometimes assumes a highly injurious form, girdling the trees at the stem base. Among the many other pathogens of citrus were mildew [*Oidium tingitaninum*: ibid., xvi, p. 153], *Nematospora coryli* (on rough lemon fruits) [ibid., xvi, p. 86], *Dothiorella* [*Botryosphaeria*] *ribis* (on mandarin oranges) [ibid., xi, p. 172], and white root rot (*Armillaria*) [*mellea*: ibid., xv, pp. 213, 280; xvi, p. 451], the last-named being successfully (but very expensively) combated by applications of sulphur to the root system combined with liming of the trunk and spraying the tree with Bordeaux mixture.

Coco-nuts (especially of the dwarf type) in the Riouw Residency, Sumatra, were affected by a wilt disease associated with *Ganoderma lucidum* and *Marasmius palmivorus* [ibid., xvi, p. 657], the latter in a secondary capacity.

Fomes noxius was widespread on the roots of coffee [ibid., xvi, p. 798]. K. Boedijn's studies on *Polyporus coffeae* are stated to have demonstrated the identity of this organism with *Bornetina* (?) *corium* [ibid., xiv, p. 357].

Clove seedlings in the Lampongs (Sumatra) were attacked by *Glomerella* and *Gloeosporium*, for the control of which Bordeaux mixture was applied.

Pepper [*Piper nigrum*] foot rot (*Phytophthora*) [*palmivora* var. *piperis*: ibid., xvi, p. 560] was responsible for irretrievable damage in Atjeh and also destroyed the susceptible varieties Djambi and Korinti in the Lampongs, where the supposedly resistant lada belantoeng was also slightly attacked.

In addition to the tea diseases already enumerated from another source [ibid., xvi, pp. 634, 798], the occurrence on this host of *Armillaria fuscipes* [ibid., xiv, p. 86] at high altitudes in West Java and of *Asterina camelliae* in West Sumatra [ibid., xiii, p. 687] may be mentioned.

Among the fungi recorded on cinchona was *Polyporus rubidus* [ibid., v, p. 843] in West Sumatra.

Pokkah-boeng (*Fusarium moniliforme*) [*Gibberella moniliformis*] was again the most important disease of sugar-cane in Java. Leaf scald (*Bacterium albilineans*) was more in evidence than in the previous year,

infection being spread by the use of insufficiently well selected planting material.

Root rot of rice [ibid., xv, p. 312; xvi, p. 339] was exceptionally virulent and widespread in Buitenzorg, Cheribon, Bodjonegoro, Kediri, and Pasoeroean (Java).

Most of the information concerning tobacco diseases has already been noticed [ibid., xvi, p. 779], but attention may here be drawn to the occurrence of stem scorch due to *Pythium* and *Rhizoctonia* [*Corticium*] *solani* [ibid., xiv, p. 743; xv, p. 403] in Sumatra, the latter fungus also being reported by the Besoeki Experiment Station (Java), where severe damage was further caused by *P. aphanidermatum* [ibid., xiv, pp. 153, 473, 743].

Sclerospora javanica was widespread on maize in the Soerakarta district of Java and elsewhere as a result of the exceptionally heavy rainfall in the early west monsoon of 1936–7.

Stapp (C.). **Der parasitäre Pflanzenkrebs.** [Parasitic crown gall of plants.]—*Neuere Ergeb. Krebskr.*, pp. 168–175, 3 figs., [? 1937].

The writer summarizes some recent studies by himself and others on the crown gall of plants caused by *Pseudomonas* [*Bacterium*] *tumefaciens* and briefly discusses the relationship of the disease to human cancer [*R.A.M.*, xvi, p. 88].

Katznelson (H.). **Bacteriophage in relation to plant diseases.**—*Bot. Rev.*, iii, 10, pp. 499–521, 1937.

A review, followed by a bibliography of 79 titles, is given of the current literature on the phenomenon of bacteriophagy in relation to plant diseases, with a section on its application to the therapy of certain animal maladies. Much of the work connected with phytopathology has been noticed from time to time in this *Review*.

Knapp (A. W.). **Cacao fermentation: a critical survey of its scientific aspects.**—xii+171 pp., 1 col. pl., 38 figs., 4 diags., 5 graphs, London, John Bale, Sons & Curnow, Ltd., 1937. Price 10*s*.

Included in this critical review of the scientific aspects of cacao fermentation are two chapters dealing with the yeasts, bacteria, and moulds [*R.A.M.*, xii, p. 149] encountered on the beans at various stages of ripening. Most of the work, e.g., by H. A. Dade and R. H. Bunting in the Gold Coast, T. Laycock in Nigeria, and R. Ciferri in Dominica, cited in connexion with mould spoilage has been noticed in this *Review*. A bibliography of 145 titles is appended.

Buller (A. H. R.). **Fusions between flexuous hyphae and pycnidiospores in Puccinia graminis.**—*Nature, Lond.*, cxli, 3557, pp. 33–34, 3 figs., 1938.

The writer recently observed, after mixing the pycnidial nectar of *Puccinia graminis*, the agent of black stem rust of wheat, on a barberry leaf, from 80 to 100 fusions between a flexuous hypha of one sex and a pycnospore of opposite sex [*R.A.M.*, xii, p. 318]. Each pycnidium sends out into the nectar 60 to 70 periphyses (straight, pointed red hairs) and a smaller number of flexuous hyphae, some of which are

branched. Several hours after the mixture of the pycnidial nectar, transverse sections of the living leaf and pycnidial pustules were mounted in water and microscopically examined. The fusion of a flexuous hypha with a pycnospore may take place either at the end or side of a flexuous hypha; in the latter case the hypha sends out towards the spore a so-called 'fusion peg' [ibid., xii, p. 777]. Shortly after fusion the main protoplasmic contents migrate from the pycnospore and from the part of the flexuous hypha that has fused with the spore, leaving behind a large vacuole. Presumably the nucleus of the pycnospore passes down the non-septate flexuous hypha towards the aecidial fundaments or proto-aecidia; these are well-defined haploid organs which after becoming diploidized develop into normal aecidia.

Young (P. A.). **Natural infection of grasses with Puccinia graminis.**—*Phytopathology*, xxvii, 10, p. 1028, 1937.

During an epidemic of wheat stem [black] rust (*Puccinia graminis*) in North Dakota in 1935, severe damage was sustained by five species of grass seedlings in nursery rows provisionally identified as *Agropyron inerme*, *A. spicatum*, *Deschampsia atropurpurea*, *Elymus condensatus*, and *Poa bulbosa*. The following species produced abundantly infected heads: *A. pauciflorum*, *A. semicostatum*, *A. smithii* (with the exception of one semi-immune strain), *A. strigosum*, *A. violaceum*, *Avena fatua*, oats, *Elymus canadensis*, *Hordeum jubatum*, and barley. *A. cristatum* proved to be immune from the rust, and *A. sibiricum*, *Bromus anomalus*, *E. pseudoagropyron*, and *E. virginicus* were only mildly infected.

Dionigi (A.). **Sullo svernamento delle ruggini (nota 1).** [On the overwintering of rusts (first note).]—*Riv. Pat. veg.*, xxvii, 9–10, pp. 275–279, 1937.

The author suggests that the perpetuation of rusts, and more particularly the wheat rusts (*Puccinia glumarum*, *P. graminis*, and *P. triticina*), from year to year in Italy [*R.A.M.*, xvi, p. 593] is ensured by the uredospores, which after their discharge on the soil or dead plant residue go through a 'lethargic' [dormant] state induced by the hot and dry summer conditions, and return to active life at the onset of winter or early spring conditions. Arguments based on general observations are given in support of this view.

Rodenhiser (H. A.) & Holton (C. S.). **Physiologic races of Tilletia tritici and T. levis.**—*J. agric. Res.*, lv, 7, pp. 483–496, 1937.

A tabulated account is given of experiments from 1934 to 1936, inclusive, carried out under comparable conditions in Montana, West Virginia, and Washington, in which 24 collections of *Tilletia tritici* [*T. caries*] and 29 of *T. levis* [*T. foetens*], each identified as a distinct physiological race of either species [*R.A.M.*, xvi, pp. 166, 517] by previous investigators, together with a number of miscellaneous collections of both species, were tested on ten differential varieties of winter and spring wheats [which are listed]. The limits of the classes of infection used in this work were somewhat widened from those admitted formerly, the varieties showing 0 to 10 per cent. infection being listed

as resistant, those exhibiting 11 to 40 per cent. infection as intermediate, and 41 to 100 per cent. as susceptible. On this basis a number of the collections tested appeared to be duplicates; eleven physiological races of *T. caries* and eight of *T. foetens* were pathogenically distinct, and have been assigned letters and race numbers T–1 to T–11, and L–1 to L–8 respectively. The fact that certain races could be differentiated on winter wheats alone, some by their reaction on spring wheats, and some more by their reaction on the combination of both kinds of wheat, emphasized the importance of including both winter and spring wheats among the differential hosts. The possibility of separating certain physiological races from mechanical mixtures of bunt by inoculations on wheat varieties generally considered to be completely susceptible was indicated by the fact that Ulka, completely susceptible to most races, was found to carry factors for resistance to T–10 and T–11. Besides differing in pathogenicity, a number of the races also varied in morphological characters of the chlamydospores and smut balls, the colour of the spore masses, and in their effect on the host plants in regard to stunting, dropping of the awns, and the degree of laxness in the spikes. Different environmental conditions determined variations in the response of Turkey (C.I. 6175) and Mindum (C.I. 5296) to certain physiological races, but not to others, and evidence was obtained that these variations were apparently due to the effect of environment on the host rather than on the parasite.

From the wheat-breeder's standpoint the results are considered to suggest the possibility of developing new varieties combining resistance to all the known bunt races with other desirable agronomic characters.

AJROLDI (P.). **Nuove ricerche intorno alla biologia delle 'Tilletia' del Frumento.** [Further investigations on the biology of *Tilletia* on Wheat.]—*Riv. Pat. veg.*, xxvii, 9–10, pp. 297–319, 1 pl., 1 diag., 3 graphs, 1937.

The results of experiments in 1936–7 at the Technical Agricultural Institute 'C. Gallini' at Voghera indicated that heavy fertilization with potassium chloride favoured the infection of the Mentana, Villa Gloria, and Damiano Chiesa wheats with bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*], while heavy applications of ammonium sulphate had the opposite effect, and superphosphate did not appear to exert any influence on infection. Of the three wheat varieties tested Mentana was the most susceptible, the percentage of infection in the plots sown to it varying from 22·4 to 41·1, as against 9·5 to 24 in the Villa Gloria and 7 to 19·6 in the Damiano Chiesa plots. The heavy infection of Mentana in 1937, following a cold and wet autumn, compared with the average of 8·5 per cent. infection in the 1935–6 trials, when the autumn was much milder and drier, again confirmed the direct bearing of environmental conditions on the susceptibility of wheat seedlings. In plots raised from seed artificially infected with both bunt species, the plants were found to be infected by each in almost equal proportions, and histological examination showed the simultaneous presence of both species in the same ear and in the same wheat grain. Attempts to induce bunt infection from the soil by wounding the roots were unsuccessful.

Milan (A.). **Prove estive sull' 'Ustilago tritici' (Pers.) Jens. con varietà di Grano precoci.** [Summer experiments on early Wheat varieties with *Ustilago tritici* (Pers.) Jens.]—*Riv. Pat. veg.*, xxvii, 9–10, pp. 287–296, 1937.

A brief description is given of a method by which the author succeeded in inducing the seed of early wheat varieties, inoculated in the spring with *Ustilago tritici* [*R.A.M.*, xvi, p. 239] and harvested as early as mid-June, to germinate and grow in small boxes to full maturity and to produce fully developed new seed by the end of the following September. This method was used by him in experiments with a number of wheat varieties from 1931 to 1937, inclusive, and the results [which are tabulated] showed it to be effective in determining the percentage of infection resulting from the spring inoculation with loose smut, prior to the normal time of sowing the grain in the autumn. The results are also stated to have again confirmed the high susceptibility to *U. tritici* of the Mentana, Rachael, and Grano 28 Ottobre wheats, and the high resistance of Littorio and of the Federation × Khapli cross. The first generation of a cross of this hybrid with Mentana and of its reciprocal was also very resistant, indicating the probability that in the Federation×Khapli hybrid resistance is dominant.

Fron (G.). **Nouvelles observations sur la maladie du piétin des céréales (campagne 1937).** [New observations on the foot rot disease of cereals (campaign of 1937).]—*C. R. Acad. Agric. Fr.*, xxiii, 25, pp. 792–800, 1 diag., 1937.

Details are given of the writer's further experiments in the control of *Cercosporella herpotrichoides* on wheat [*R.A.M.*, xv, p. 145], from which it appears that the best results were given by an autumn treatment of the seed-grain with neutral ortho-oxyquinoline sulphate [ibid., xvi, p. 350] (dusting at the rate of 30 gm. per quintal or immersion in a solution of 30 gm. in 8 l. water per quintal), followed towards the end of March by the application to the soil of 100 gm. ortho-oxyquinoline sulphate incorporated in 200 kg. complete fertilizer per hect. The estimated increase of yield thus obtained amounted to between 12 and 15 per cent. Seed treatment alone augmented the yield by 2 and fertilizing alone by 4·31 quintals per hect. The action of ortho-oxyquinoline sulphate on plants appears to be of the very delicate order associated with the operation of phytohormones.

Hynes (H. J.). **Studies on Rhizoctonia root-rot of Wheat and Oats.**—*Sci. Bull. Dep. Agric. N.S.W.* 58, 42 pp., 18 figs., 1937.

Heavy losses may be caused in certain limited areas of the New South Wales, South Australia, and Victoria wheat belt by a root rot of wheat and oats due to *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xiv, p. 559; xv, p. 24; xvi, p. 801; xvii, p. 97], which develops during the winter months and may abate to some extent with the onset of milder conditions. Infection occurs in the field in the shape of well-defined, circular or irregular patches, ranging from about 1 ft. in diameter to areas covering $\frac{3}{4}$ acre or more, and presenting from a distance a slightly purplish appearance, especially in the case of oats, or sometimes a conspicuously yellow tinge. Such plants as recover from the disease are stunted, of a

darker green than the normal, late in maturing, and bear few tillers and small heads. Where recovery does not take place, as on poorly prepared land, the plants die out in patches in the early spring, leaving prominent 'holes' throughout the crop. Oats are more likely than wheat to recuperate after early infection. The average height of diseased wheat plants was found to be only $4\frac{1}{2}$ in. as against 11 in. for healthy ones, the corresponding figures for shoot numbers being 1 and $2\frac{1}{2}$, respectively. The leaves of affected plants (about four per seedling) are very narrow, rolled, erect, and sometimes exhibit a more or less extensive purplish tinge (naphthalene violet and vernonia purple of Ridgway). Both the primary and secondary root systems were rotted, the former being poorly developed and measuring $\frac{1}{2}$ to 3 in. in length and the latter composed of three or four diseased stubs, $\frac{1}{8}$ to 1 in. long. Diseased roots are readily decorticated, the portion thus exposed being of a dull tan colour and containing the characteristic hyaline hyphae of the fungus, 9 to 10 μ in diameter. The basal sheaths are of a marked tan colour and occupied by both hyaline and brown hyphae, the latter measuring 6·6 to 9·9 μ in diameter. The symptoms on oats are similar to the foregoing. The average height and shoot number of affected plants are 4 in. and $1\frac{1}{2}$, respectively, as compared with 12 in. and 5 for healthy specimens. Each diseased seedling bears only about five leaves and the growth habit is erect and stiff. The purplish discoloration, when present, is much darker than that of wheat, agreeing closely with Ridgway's cotinga purple. Injury to the root system is similar to that described for wheat but generally less extensive.

Two cereal strains of *C. solani*, exhibiting marked differences in growth rate on agar and in pathogenicity on seedlings, were isolated from diseased plants, the optimum temperature for the development of one being 20° and of the other 20° to 25° C. The addition of ammonium sulphate to glucose or 'radicicola' agar in amounts constituting 0·5 to 0·25 per cent. of the medium retarded the growth of the pathogen. The results of extensive cross-inoculation experiments showed that strains of *C. solani* from cereals and potato are capable of inducing marked stunting in Nabawa wheat, Algerian oats, Cape Barley, and Black Winter rye seedlings and Factor potato shoots.

Relatively low temperatures were shown by field observations and greenhouse tests to favour the development of root rot in wheat and oats. In controlled trials soil moisture was not a limiting factor in the incidence of infection at low temperatures, but at high ones the symptoms were most severe in soils with a low moisture content. In striking contrast to *Helminthosporium sativum* and *H.*M. [*Curvularia ramosa*: ibid., xvi, p. 735], which were tested concurrently, *Corticium solani* is of comparatively slight importance in the causation of pre-emergence blight.

Chemical analyses of soil samples from the diseased areas revealed a relatively low lime content (P_H 6 to 6·3). In an extensive series of pot experiments, calcium hydrate, ammonium sulphate, and horse manure each inhibited the development of root rot in Nabawa wheat, with residual effects in the case of the two first named. The results of three years' field tests indicated that the application of ammonium sulphate to the soil at the rate of 1 or 2 cwt. per acre exerts a definitely curative

effect in the case of Buddah oats, but is of questionable value with wheat.

SIMMONDS (P. M.) & LEDINGHAM (R. J.). **A study of the fungous flora of Wheat roots.**—*Sci. Agric.*, xviii, 2, pp. 49–59, 1 pl., 1 fig., 1937.

A full list is given of the fungi (comprised in 27 genera) identified by the authors among 806 isolates from the subcrown internode and the roots of wheat plants excavated in 1935 and 1936 at Saskatoon and Indian Head, Saskatchewan, in connexion with their studies of the wheat root rot problem in Canada [*R.A.M.*, xiv, p. 748]. The majority of the fungi were isolated from the plant organs developing in the first foot of soil from the surface, in which well-known species pathogenic to cereals were also the most abundant, such as *Helminthosporium sativum* and *Fusarium* spp., representing roughly 10 and 40 per cent., respectively, of all the isolates and rarely occurring at greater depths. Most of the species obtained from the lower levels were slow growing forms, including *Geomyces vulgaris*, *Botrytis* sp., *B. terrestris*, and *Cylindrocarpon* sp., but certain species, such as *Colletotrichum* sp. and *Penicillium* sp. were present at most levels. While the *Colletotrichum* was severely parasitic to wheat, the pathogenic significance of *Penicillium* sp., as well as that of *G. vulgaris* and *Cylindrocarpon* sp., as far as cereals are concerned, is difficult to evaluate at present. *Cephalosporium curtipes*, isolated from a depth of 3 ft., and *Trichoderma koningi* were virulently pathogenic to wheat seedlings in laboratory tests. Isolations in 1935 from decayed, presumably old cereal roots collected at various levels in the soil, yielded, in addition to a fungal flora similar to that obtained from living roots, other species among which the following may be mentioned: *Fusarium sambucinum* [ibid., xv, p. 643] and *F. solani* from the first foot, and *Monotospora daleae* [ibid., xv, p. 741] from the second foot layer. A brief description is given of a Phycomycetous fungus, considered to be of the mycorrhizal type, which was commonly seen in many of the seminal root collections. Direct microscopical examination of preserved material showed that lesions of the roots are of rare occurrence below the first foot of soil.

STEYAERT (R. L.). **Présence du Sclerospora maydis (Rac.) Palm (S. javanica Palm) au Congo belge.** [The presence of *Sclerospora maydis* (Rac.) Palm (*S. javanica* Palm) in the Belgian Congo.]—*Publ. Inst. nat. Étud. agron. Congo belge*, Sér. sci. 13, 16 pp., 1 pl., 1937.

In connexion with the detection in the Uele district of the Belgian Congo of *Sclerospora maydis* [*R.A.M.*, xi, p. 546] on maize, the writer describes the symptoms of the disease and the morphology of the causal organism, discusses the taxonomy of the latter and of related species of *Sclerospora*, and briefly summarizes the very fragmentary knowledge available concerning the distribution of members of this genus in Africa.

[JENSEN (J. H.).] **Plant-disease investigations.**—*Rep. P.R. agric. Exp. Sta., 1936*, pp. 67–69, 1 fig., 1937.

The following item occurs in the course of a report on phytopathological investigations in Porto Rico in 1936. Seeds from healthy maize plants and those suffering from stripe [*R.A.M.*, xv, p. 529] were planted

separately in a cage screened to exclude the insect vector, *Peregrinus maidis*, and also in unprotected areas exposed to leafhopper infestation. No pathological symptoms appeared on any plants developing from seed from diseased plants when protected against insect contamination, whereas 30 out of 583 plants from the same lot of seed but unprotected contracted symptoms. Similar results were obtained with seed from healthy plants. These data are considered to indicate that seed transmission of maize stripe rarely, if ever, takes place.

CHERIAN (M. C.) & KYLASAM (M. S.). **Preliminary studies on the 'freckled yellow' and 'stripe' diseases of Cholam.**—*Proc. Ass. econ. Biol., Coimbatore, 1936*, iv, pp. 57–63, 1 pl., 1937.

Sorghum in the Coimbatore district of India is subject to two forms of leaf-yellowing [cf. *R.A.M.*, xv, p. 778], one designated 'freckled yellow' and the other 'stripe'. The former condition is characterized by minute, creamy-yellow specks arranged in a linear series either near the midrib or close to either margin of the leaf blade. With each successive leaf the intensity of the freckling increases until the specks finally coalesce to form broad, yellow bands. In severe cases the top leaves do not unfurl properly but remain close and twisted, while the apical shoot assumes an arched form like whipcord. Such plants seldom produce ear-heads. In the 'stripe' form of the disorder the leaf blades exhibit a few parallel, contiguous, pale green streaks, while the veins and the immediately adjacent tissue become lighter in colour. The interveinal area is occupied by two or three semi-continuous white streaks running parallel to the veins. The shortened internodes impart a 'bunchy top' aspect to the plant, the colour of which as a whole is an unusually light green. Both these types of yellowing may co-exist in a single plant. The total incidence of both disturbances was shown by counts made from October to December, 1935, to amount to about 14 per cent. of the stand, the corresponding figure in 1936 being 26·5 per cent. 'Freckled yellow' is the more infectious of the two conditions and in 1935 reduced ear head production by nearly 50 per cent. Ragi [*Eleusine corocana*], cumbu [*Pennisetum typhoides*], and maize have been observed to manifest symptoms closely resembling the foregoing, and moreover the shoot bug (*Peregrinus maidis*), which was experimentally shown to transmit freckling (but not stripe) from diseased to healthy plants, breeds on all these cereals. Analogous markings were further noticed on various grasses, such as *Brachiaria ramosa*, *B. distochya*, and *Dichanthum annulatum*, which may possibly act as alternate hosts of the virus evidently concerned in the etiology of the yellowing.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlviii, 9, pp. 501–504, 5 figs., 1937.

Leaf-yellowing of citrus appeared suddenly in New South Wales about 1930 on sand and sandy loam soils, causing reduction of crop and vigour of growth but no actual die-back of the twigs. The young foliage was quite normal in spring but diffuse yellow blotches developed on the leaves in early autumn, and the chlorotic leaves were shed prematurely. Chemical analyses showed a deficiency of magnesium both in the diseased

leaves and in the affected soils. Applications of dolomitic limestone at the rates of ½ ton and 2 tons per acre applied in 1932 to badly affected 5-year-old Valencia oranges resulted in marked improvement, which first became evident in the autumn of 1935 and has been maintained since except that the trees given the ½ ton dressing showed slight leaf-yellowing in 1935–6. An early spring dressing of 1 ton per acre is recommended.

Notes are also given on wheat stem rust [*Puccinia graminis*], estimated to cause an annual loss of £250,000 to the State, control of apple black spot [scab] (*Venturia inaequalis*), and bacterial blight [*Bacterium medicaginis* var. *phaseolicola*] of beans [*Phaseolus vulgaris*]. Against the last-named disease the Department of Agriculture has fostered the production of high-grade seed from clean crops and within a few years all the bean seed required will probably be produced locally.

BENTON (R. J.). **Mottle leaf of Citrus trees. Control by zinc sulphate sprays demonstrated.**—*Agric. Gaz. N.S.W.*, xlviii, 10, pp. 571–572, 580, 3 figs., 1937.

Mottle leaf of citrus trees [*R.A.M.*, xvii, p. 106] is stated to be common in citrus trees growing under irrigated conditions in inland areas of New South Wales. In experiments in 1936–7 at Curlwaa and Leeton, on Navel, Valencia Late, and Mediterranean Sweet orange trees, some of which showed 80 to 90 per cent. mottle leaf, striking improvement resulted from the application in mid-September of a spray consisting of 10 lb. zinc sulphate, 5 lb. hydrated lime, and 4 oz. black albumen spreader in 100 galls. water. The improvement was not quite so marked, though definite, when the trees were sprayed in November and January.

MENDES (L. O. T.). **Resultados experimentais obtidos num estudo sobre os meios de combate a 'verrugose' (Sphaceloma australis Bit. & Jenk. 1936) da Laranja doce (Citrus sinensis Osb.).** [Experimental results obtained in the study of methods of combating 'scab' (*Sphaceloma australis* Bit. & Jenk. 1936) of the Sweet Orange (*Citrus sinensis* Osb.).]—Reprinted from *Rev. Agric., S. Paulo*, xii, 8–9, 27 pp., 1937. [English summary.]

A tabulated account is given of the writer's experiments at Sorocaba, São Paulo, Brazil, in the control of sweet orange scab, caused by *Elsinoe* (*Sphaceloma*) *australis* [*R.A.M.*, xvii, p. 27], from which it appears that 1 per cent. Bordeaux mixture is more effective for this purpose than solbar or Bayer's Bordeaux dust. Two applications are generally sufficient, the first to be made immediately after flowering and the second some 60 days later, when the fruits attain a diameter of 1·5 cm. The addition of mineral oil to the mixture is advisable for the simultaneous control of coccids.

BITANCOURT (A. A.). **As prodridões das Laranjas na safra de 1936.** [Rots of Oranges in the 1936 crop.]—*Biologico*, iii, 9, pp. 255–263, 1 pl., 1 graph, 1937.

The results of the mycological investigation of 18 boxes of Pera and Bahia oranges received from June to September, 1936, inclusive, at

São Paulo from various citrus-growing centres in the States of São Paulo, Rio de Janeiro, and the Districto Federal in Brazil, showed that the oranges coming from the two last-named areas and the 'Central' region of the State of São Paulo were chiefly attacked by stem-end rot mostly caused by *Phomopsis* [*Diaporthe*] *citri* and to a lesser extent by *Diplodia natalensis* [*R.A.M.*, xvi, p. 744] and *Dothiorella* [*Botryosphaeria*] *ribis*. As far as the author is aware, this is the first record of *B. ribis* on orange from Brazil, where it was found, however, causing a black rot of avocado pear. The oranges from the remainder of the State of São Paulo were mostly attacked by green rot (*Penicillium digitatum*), and to a lesser degree by blue mould (*P. italicum*). A total not exceeding 5 per cent. of all the fruits examined were found to be rotted by *Rhizopus nigricans, Colletotrichum gloeosporioides, Oospora citri-aurantii* [ibid., xvi, p. 601], and some other undetermined fungi.

Baker (R. E. D.). **Gummosis of Citrus in Trinidad. III. Notes on the control of the disease in old plantations.**—*Trop. Agriculture, Trin.*, xiv, 9, pp. 255–256, 3 figs., 1937.

The experiment described in this paper was carried out during 1934–7 on a block of 572 Marsh grape-fruit trees from 9 to 12 years old, almost all of which were low-grafted and had low branches reaching the ground, in a field where the conditions are generally calculated to be favourable to gummosis (*Phytophthora parasitica*) [*R.A.M.*, xvi, p. 312] in Trinidad. A survey in 1934 showed that 162 of the trees (28 per cent.) were attacked by the disease to a greater or lesser extent, and that 39 were already dead. The trees were drastically pruned and trimmed until the trunks were cleared of all foliage within 5 or 6 ft. from the ground, no antiseptic dressing being used to cover the wounds. All the infected bark was then carefully excised until clean, healthy tissue could be seen all around the lesions, the operation being performed at the height of the dry season, and the wounds left simply to dry and heal without the use of any antiseptic; under wet conditions the use of Bordeaux paste, followed by Stockholm tar or some other similar dressing, might be advisable. Furthermore, all the diseased trees were inarched on to two, three, or four sour orange plants of varying sizes and ages, with the result that many of the more seriously attacked trees (25 out of 44) have been saved, and are giving good crops of fruit. These measures are claimed to have effectively arrested the disease in 122 trees by April, 1937, and, of the 162 trees that had been treated in 1934, 80 have never been attacked since. Most of the dead trees in the experimental field have been replaced with young high-grafted trees, and the whole field is stated to be now in a better condition than in 1934 and to be capable of yielding good crops for many years to come. The results show undoubtedly that gummosis can be successfully controlled under Trinidad conditions even on trees of a type liable to the disease.

Rudin (W.). **Topsterftebestrijding in de practijk. III.** [Top die-back control in practice. III.]—*Bergcultures*, xi, 41, p. 1471, 1937.

The writer considers that in combating top die-back of coffee [*Rhizoctonia* sp.: *R.A.M.*, xvii, p. 108], it is of the utmost importance

to guard against the penetration of the fungus through pruning wounds. The coolies' practice of carrying baskets piled up with excised debris through a densely planted estate is deprecated, and in the absence of arrangements for burning on the spot, the baskets should not be filled to the brim and should be covered with sacking before transport. They should be immersed overnight in a fungicidal solution. The disinfection of pruning saws and knives after the treatment of each tree or group of trees is also advisable.

HENDERSON (LETA). **Studies on the infection of Cotton seedlings by Phymatotrichum omnivorum.**—*Amer. J. Bot.*, xxiv, 8, pp. 547–552, 3 figs., 1937.

Using a culture medium (either as liquid or in sand) suitable for green plants with sufficient dextrose added to permit the growth of the cotton root rot fungus, *Phymatotrichum omnivorum* [*R.A.M.*, xvii, p. 109], experimental infections were carried out under controlled conditions, the Acala cotton seed used being disinfected and the seedlings raised under sterile conditions before transference to the culture tubes inoculated with the fungus. The results showed that infection of the cotton seedlings occurs at the surface of the medium only in the presence of oxygen approximating to atmospheric concentrations. Waterlogged conditions in the soil therefore would tend to prevent infection, which would be limited to the moist soil surface above the water table. The thermostable staling products of *P. omnivorum* effectively check the growth of cotton roots and might be expected to check the development of the plant in the field, but probably this does not take place since the staling products are adsorbed and decomposed. Cultures of the fungus freshly isolated from field material show higher rates of growth and infection than they exhibit after culture for several months. Virulence of the fungus is largely a matter of vigour of growth, but cultures attenuated by prolonged growth on artificial media may be reactivated by two or more passages through living cotton plants. In the field, therefore, rapid spread would not be expected from saprophytic sources of infection but only from the fungus in an active parasitic phase. The interpolation of a resistant rotational crop may therefore decrease subsequent infection, whereas susceptible weeds may be the means of perpetuating virulent cultures over a period when cotton is not grown.

THOM (C.) & MORROW (MARIE B.). **Experiments with mold inoculation in Cotton root rot areas.**—*Proc. Soil Sci. Soc. Amer., 1936*, i, p. 223, 1937. [Mimeographed.]

Following up King's hypothesis that cotton root rot (*Phymatotrichum*) [*omnivorum*] becomes dominant as a result of the continuous production of the crop on certain neutral to alkaline soils, the writers found that few or none of the moulds shown by recent studies to be antagonistic to the pathogen were present in rot-infected areas. A selected series of such moulds, e.g., *Trichoderma* [? *lignorum*, *R.A.M.*, xiv, p. 739], inoculated into experimental plots, were recovered in sufficient numbers to justify further investigations along the same lines.

SCHEPKINA [SHTSHEPKINA] (Mme T. V.). Микрохимический способ обнаружения микрофлоры и производимого ею повреждения внутри Хлопковых волокон. [A microchemical method for the determination of the microflora present in Cotton fibres and of the injury caused by it to the fibres.]—*Bull. Acad. Sci. U.R.S.S., 1937*, Sér. biol., 3, pp. 619–634, 1 col. pl., 2 figs., 1937. [English summary.]

The author states that in the course of colorimetric studies involving the use of bromphenol blue as indicator, primarily designed for the determination of the degree of maturity of cotton fibres, it was frequently observed that individual fibres did not stain uniformly over the whole of their length, but presented a spotted or speckled aspect. Further investigations showed that these irregularities in staining were due to the presence, both outside and inside the fibres, of a complex microflora, containing organisms capable of destroying cellulose, since the tensile strength of such fibres was found to be considerably impaired. The examination of a wide range of American and Egyptian baled cottons imported from abroad showed the presence in them of a high percentage (occasionally as much as 80 per cent.) of such fibres. While no systematic study of the microflora was undertaken, it was noted that it comprised widely differing organisms, including besides two bacterial strains, resembling *Bacillus mesentericus* and *B. subtilis*, respectively, species of *Penicillium* and *Aspergillus*, and an Actinomycete, a very minute fungus which was very frequently found growing spirally around the fibres and actively destroying the cellulose of their walls. The same fungus was also detected, with the help of bromphenol blue, growing in the walls of the fibres, in the seeds still enclosed in the bolls, and in the leaves of cotton plants collected in 1936 in Azerbaijan as suffering from a virus disease. The fungus eventually forms on the surface of fibres mulberry-shaped, bright lilac, but later blue fruiting bodies, which break up and liberate hyaline spores.

SPARROW (F. K.). **Some Chytridiaceous inhabitants of submerged insect exuviae.**—*Proc. Amer. phil. Soc.*, lxxviii, 1, pp. 23–60, 4 pl., 5 figs., 1937.

A remarkable fungus flora has been observed to develop in the submerged exuviae (cast-off integuments) of midges (Chironomidae), mayflies (Ephemerida), dragonflies (Odonata), and caddis flies (Phryganeidae), consisting largely of Chytridiales [*R.A.M.*, xv, p. 670], though representatives of the Saprolegniales, notably *Aphanomyces* spp., may also be present. Nine species of the former family, collected in Denmark, England, and the United States, are described in considerable detail; four of these are apparently new to science and are furnished with English and Latin diagnoses.

LEPESME (P.). **Sur la présence du Bacillus prodigiosus chez le Criquet pélerin (Schistocerca gregaria Forsk).** [On the presence of *Bacillus prodigiosus* in the Desert Locust (*Schistocerca gregaria* Forsk).]—*Bull. Soc. Hist. nat. Afr. N.*, xxviii, 6, pp. 406–411, 1937.

Bacillus prodigiosus was isolated on peptonized meat bouillon and on agar from the blood of adult desert locusts (*Schistocerca gregaria*)

which succumbed to an epidemic developing at the Central Laboratory of Locust Biology, Natural History Museum, Algiers, at the end of December, 1936, and persisted throughout the following January. Shortly after death the bodies of the diseased insects assumed a characteristic reddish tinge, especially on the abdomen.

E. Masera's experiments on silkworms (*Bombyx mori*) at Padua showed that inoculation with *B. prodigiosus* is fatal, whereas the results of ingestion of the organism vary with the age of the insects, larvae of the fifth stage being much more susceptible than younger ones [*R.A.M.*, xvi, p. 530], as is also the case with *S. gregaria.* According to the same authority, *Pyrausta nubilalis* is killed by *B. prodigiosus* both by inoculation and ingestion, while in the case of *Galleria mellonella* only the former method produces lethal results. In the writer's experiments, *B. prodigiosus*, just isolated from sick or dead locusts, killed individuals of *S. gregaria* in 12 hours by inoculation and in 24 by ingestion, whereas after repeated subculturing the former method only was effective and death was delayed for three days. It was not possible to recover *B. prodigiosus* from the alimentary canal of the infected locusts, but only from the blood. The presence of the pathogen in the eggs, however, was clearly demonstrated by the red colour of their interior.

Preininger (T.). **Durch Maisbrand (Ustilago maydis) bedingte Dermatomykose.** [Dermatomycosis caused by Maize smut (*Ustilago maydis*).]—*Arch. Derm. Syph., Berl.*, clxxvi, 2, pp. 108–113, 3 figs., 1937.

The agent of maize smut (*Ustilago maydis*) [*U. zeae*: *R.A.M.*, xvi, p. 738] was isolated in October, 1936, from the epithelial layers of extensive inflamed areas on the body and extremities of a Hungarian agricultural labourer. A comparison of the organism with the fungus from a maize plant in the field where the work was carried on left no doubt as to its identity.

Conant (N. F.). **Studies in the genus Microsporum. III. Taxonomic studies.**—*Arch. Derm. Syph., Chicago,* xxxvi, 4, pp. 781–808, 7 pl., 1937.

A detailed study of nine representative species of *Microsporum* [*R.A.M.*, xv, p. 721] (Gruby's original spelling though he used *Microsporon* the next year) is presented, the morphological characters essential to the recognition of the species having been developed on polished rice cultures. The most important feature from the standpoint of specific differentiation was the macroconidia (fuseaux) produced in culture, which are characterized according to size, shape and character of the wall, and colour. Subsidiary characters, such as arrangement, size, and character of the conidiophores, and methods of macroconidial production, were also observed and taken into consideration for a clear definition of the species, a key to which is included for convenient and easy identification. Full technical descriptions are given of all the species studied, including five old species recognized as valid, viz., *M. audouini, M. canis, M. equinum, M. fulvum,* and *M. gypseum,* and four new ones, *M. aurantiacum, M. pseudosolanosum, M. simiae,* and *M. obesum*, which are accompanied by Latin diagnoses.

M. aurantiacum, isolated from the scalp of a boy, is characterized by cinnamon-coloured colonies, conidiophores 35 to 120 by 2 to 3·5 μ, bearing on ascending branches 5- to 11-septate macroconidia ranging from 52 to 90 by 15 to 22 μ (mostly 64 to 72 by 18 to 19 μ), tapering towards the apical and basal cells, ovoid to piriform, pleurogenous or acrogenous microconidia, 3·5 to 6 by 2 to 3·5 μ, sessile or on short sterigmata, relatively large nodular bodies, and numerous 'racquet' hyphae.

M. pseudosolanosum, obtained from a man's hand, forms pinkish-buff colonies and produces extensively branched conidiophores, 20 to 40 by 2 to 3·5 μ, 2- to 10-septate, slender, fusoid macroconidia, 46 to 80 by 12 to 22 μ (mostly 64 to 68 by 16 to 20 μ), piriform to elongate-ellipsoid, and usually sessile microconidia, 3 to 4 by 1·5 to 2 μ.

The colonies of *M. obesum*, also isolated from a boy's scalp, are cartridge-buff; the 4- to 11-septate, narrowly obovate macroconidia, bluntly rounded at the apex, tapering towards the base, borne on conidiophores measuring 10 to 40 by 2 to 2·5 μ, expanding upwards to 5 μ, range from 38 to 78 by 12 to 20 μ (mostly 48 to 56 by 16 to 18 μ), and the microconidia, which are sessile, or borne on slender sterigmata on short lateral branches, are 2 to 5 by 1·5 to 2·5 μ.

M. simiae, isolated from a monkey, forms a loose, white, cottony aerial mycelium concealing a light buff, powdery layer of 5- to 9-septate macroconidia, 48 to 76 by 14 to 20 μ (mostly 54 to 58 by 16 μ), tapering towards the apical and basal cells, borne on branched conidiophores, 30 to 40 by 2 to 3 μ, and microconidia measuring 4 to 6 by 1·5 μ borne on slender branches up to 10 μ in length.

STEVENIN (G.). **Trois cas de microsporie humaine d'origine animale.** [Three cases of human microsporosis of animal origin.]—*Rec. Méd. vét.*, cxiii, 3, pp. 149–151, 1937.

An account is given of an outbreak of ringworm of the hands and neck among three students at the Alfort Veterinary College [Seine, France]. The agent of the disorder, *Microsporon felineum* [*R.A.M.*, xvii, p. 37], is believed to have originated in cultures of infected cat's hairs, in the study of which one of the students was engaged.

RIMBAUD (P.). **L'utilisation de la lumière de Wood pour le diagnostic et la surveillance du traitement des teignes tondantes.** [The utilization of Wood's rays for the diagnosis and supervision of the treatment of scalp ringworms.]—*Gaz. Hôp., Paris*, cx, 48, pp. 780–781, 1937.

Excellent results are stated to have been obtained in France by the use of Wood's rays for the differential diagnosis of ringworms (*Microsporon* and *Trichophyton* spp.) and favus [*Achorion* spp.] of the juvenile scalp [*R.A.M.*, xv, p. 510]. Directions are given for the application of the method, and its extended use advocated.

CUMMER (C. L.). **Tinea capitis with kerion in an adult caused by Trichophyton lacticolor.**—*Arch. Derm. Syph., Chicago*, xxxvi, 4, pp. 844–845, 1937.

Brief clinical details are given of a case of tinea capitis and kerion

in a 37-year-old man associated with a fungus which was isolated on Sabouraud's medium and identified by J. Gammel and Pollacci as *Trichophyton gypseum lacticolor* [*T. mentagrophytes*: *R.A.M.*, xii, p. 695].

USHER (B.) & MITCHELL (D. S.). **Study of an epidemic of ringworm of the extremities in an orphans' home.**—*Canad. med. Ass. J.*, xxxvii, 1, pp. 60–62, 1937.

Clinical evidence of ringworm of the toes of the feet was revealed by the examination of all 65 children in a Montreal orphanage and positive cultures of *Trichophyton interdigitale* [*R.A.M.*, xvi, pp. 316, 810] were obtained from 21 (32 per cent.).

KUSKE (H.). **Über allergische Allgemeinexantheme bei Favus.** [On allergic generalized exanthema in favus.]—*Derm. Z.*, lxxvi, 4, pp. 125–138, 4 figs., 1937.

A critical discussion, amplified by clinical observations, is given of ten cases (nine in one family) of favus (*Achorion schoenleini*) investigated during the period 1921–34 at the Berne University Clinic, in two of which extension in the form of generalized allergic exanthema (favid) was definitely proved, while in a third it was regarded as questionable.

WAGNER (H. C.) & RACKEMANN (F. M.). **Kapok and molds: an important combination.**—*Ann. intern. Med.*, xi, 3, pp. 505–513, 1937.

Steam sterilization of vegetable (cotton and kapok [*Ceiba pentandra*]) or silk floss fibres changes the material in such a way as to preclude the active growth of moulds, e.g., *Aspergillus niger*, *Rhizopus nigricans*, and *Penicillium* and *Chaetomium* spp., involved in the causation of asthma [cf. *R.A.M.*, xvi, p. 675], which will, however, develop on boll cotton and bale kapok, especially when the fungi originate in samples of old kapok, cotton lint, or house dust. The skin-test active principle is directly proportional to mould growth and is thus much more marked in 120- than in 60-day cultures and when unsterilized material is inoculated.

CAVALLERO (C.). **Observations sur la biologie du 'champignon de muguet' [Mycotorula albicans (Robin) Langeron et Talice, 1932].** [Observations on the biology of the 'thrush' fungus (*Mycotorula albicans* [Robin] Langeron et Talice, 1932).—*Boll. Sez. ital. Soc. int. Microbiol.*, ix, 7, pp. 237–247; 8, pp. 257–259, 262–267, 1937.

The results of inoculation experiments on laboratory animals with twelve strains of *Mycotorula* [*Candida*] *albicans* [*R.A.M.*, xvii, p. 111] from various sources showed that some are devoid of all pathogenic influence, or at any rate incapable of adapting themselves to the living tissue, others are pathogenic to animals whatever their source and whether injurious or otherwise to man, while yet others are pathogenic both to man and animals. Inoculation with *C. albicans* induces in animals characteristic modifications in the blood serum discernible by complement deviation tests. The antibodies forming part of this reaction can be demonstrated in the serum of inoculated animals after

a month of illness and their numbers increase with each successive inoculation. The reaction is positive in respect both of the antigen prepared from the specific strain employed and of that derived from other strains of the same species but not of unrelated organisms. Proof was further obtained of cutaneous allergy in the animals inoculated with *C. albicans*, but this reaction was not strictly specific, being evoked in a modified form by antigens of other fungi. The reactions displayed by the animals immunized against *C. albicans* by vaccination (with the fungus killed by heat) or premunition (with the living organism) are considered to partake of the nature of hyper-receptivity rather than of allergy *sensu stricto*.

Turu (H.). **Beitrag zur Pathogenese der Faulecke (Perlèche).** [A contribution to the pathogenesis of perlèche.]—*Hihu-to-Hitunyo, Hukuoka*, v, pp. 406–412, 1937. [Japanese. Abs. in *Zbl. Haut- u. GeschlKr.*, lvii, 9, p. 694, 1938.]

From the middle of September, 1935, to the middle of February, 1937, the writer isolated yeast-like fungi from the corners of the mouth in 27 of the 60 patients (45 per cent.) suffering from 'perlèche' [*R.A.M.*, ix, p. 382]. The disorder may affect persons of any age, but is most prevalent during the twenties, infection being generally bilateral. The fungi are believed to play an etiological part in the condition.

Black (R. A.) & Fisher (C. Virginia). **Cryptococcic bronchopneumonia.**—*Amer. J. Dis. Child.*, liv, 1, pp. 81–88, 3 figs., 1 graph, 1937.

Full clinical details are presented of a case of bronchopneumonia in a ten-year-old boy yielding no laboratory evidence of pathogenic bacteria in the nasopharynx or sputum, cultures from which on Sabouraud's medium (subsequently transferred to 6 per cent. honey agar) gave rise, however, to full, round, creamy-tan colonies composed of oval budding forms, 2 to 3 by 1 to 2 μ. The organism, which is identified as *Cryptococcus glabratus* Anderson (*J. infect. Dis.*, xxi, p. 341, 1917), produced acid and gas from dextrose, levulose, and mannose but did not liquefy gelatine; it proved to be pathogenic to white rats in laboratory experiments. The systematic position of the genus is discussed in relation to recent taxonomic studies.

Croveri (P.) & Zeglio (P.). **Micosi broncopolmonare pura da Cryptococcus (Torulopsis) sp.** [Primary bronchopulmonary mycosis due to *Cryptococcus* (*Torulopsis*) sp.]—*Arch. Sci. med.*, lxiii, 5, pp. 351–378, 13 figs., 1937.

A comprehensive account is given of the writers' studies in connexion with a case of primary bronchopulmonary mycosis in a 29-year-old woman, the causal organism of which was identified as a species of *Cryptococcus* (or *Torulopsis*), characterized on acid carrot agar by a compact growth of creamy consistency and yellow coloration giving rise to round or oval, double-walled, granular, guttulate, budding cells, 5 to 10 by 4 to 6 μ. Further researches on the fungus are in progress.

JUNGHANNS (H.). **Eine seltene Hefepilzerkrankung der Haut mit Epithelwucherungen (Blastomykose, Gilchristsche Krankheit).** [A rare yeast fungus disease of the skin with epithelial excrescences (blastomycosis, Gilchrist's disease).]—*Virchows Arch.*, ccxcix, 4, pp. 767–774, 7 figs., 1937.

Full clinical details are given of a mild case of blastomycosis or Gilchrist's disease [*Endomyces dermatitidis: R.A.M.*, xvi, p. 384] in a 28-year-old woman. The occurrence of this condition is stated to be very exceptional in Germany.

CONANT (N. F.). **The occurrence of a human pathogenic fungus as a saprophyte in nature.**—*Mycologia*, xxix, 5, pp. 597–598, 1937.

From a careful study of the eight species of *Cadophora* [*R.A.M.*, ix, p. 77; xiv, pp. 274, 729] so far described, all occurring on lumber and pulp, and three strains of *Phialophora verrucosa* [ibid., xvi, p. 812] isolated from man the author concludes that these fungi belong to the same genus, the endogenous conidial formation, with ampullaceous conidiophores having funnel- or cup-like structures at the apices, being common to all. *Cadophora* must therefore become a synonym of *Phialophora*. *C. americana* [ibid., xiv, p. 274] is a synonym of *P. verrucosa*, and the following species of *Cadophora* [ibid., xvii, p. 84] are transferred: *P. fastigiata* (Lagerb. & Melin) Conant, *P. brunnescens* (Davidson) Conant, *P. lagerbergii* (Melin & Nannf.) Conant, *P. melinii* (Nannf.) Conant, *P. obscura* (Nannf.) Conant, *P. repens* (Davidson) Conant, and *P. richardsiae* (Nannf.) Conant. The occurrence of the human pathogen *P. verrucosa* on wood pulp and timber is of interest.

DELAMATER (E. D.). **Eidamella spinosa (Matruchot and Dassonville) refound.**—*Mycologia*, xxix, 5, pp. 572–582, 2 pl., 1 fig., 1937.

A fungus isolated from a finger-nail in Boston in 1935 has been identified as *Eidamella spinosa*. It produces perithecia in abundance in culture and the vegetative growth resembles that of many of the true dermatophytes. Thick-walled intercalary chlamydospores are formed in large numbers, and terminal chlamydospores are less regularly seen. On honey, maltose, and other agars a blood-red pigment is produced, but the mycelium is pure white, except that hyphae in contact with the substratum become coloured and at the inception of the perithecial stage it becomes speckled grey-black. The refinding of *E. spinosa*, the ascigerous stage of which is described, reopens the question of the position of the ringworm fungi in the Gymnoascaceae [*R.A.M.*, xi, p. 575] instead of in the Fungi Imperfecti. But the author is of opinion that there is as yet no justification for the reclassification of the dermatophytes among the Gymnoascaceae, as Langeron and Milochevitch, Nannizzi, and others have done, since such a step can only be based upon the finding of the sexual stage in an undoubted pathogen. In the present instance the writer was unable to produce typical ringworm lesions with his cultures, but infection is very difficult to secure with ringworm fungi and the fact that the fungus has been found twice in definitely pathological conditions is suggestive, though by no means final. The author does not agree with C. W. Dodge (Medical Mycology [p. 430]) [ibid., xv, p. 368] in regarding *E. spinosa* as a synonym of *Gymnoascus setosus*.

OOMEN (H. A. P. C.). **Een schimmel (Cephalosporium spec.). als epiphyt op een niersteen.** [A fungus (*Cephalosporium* spec.) as epiphyte on a renal calculus.]—*Ned. Tijdschr. Geneesk.*, lxxxi (iii), 31, pp. 3659–3667, 1 pl., 1937. [German and English summaries.]

Full clinical details are given of a fatal case of mycotic infection of the kidney in a 44-year-old man associated with the presence on an oxalate renal calculus of the fungus previously referred to as *Acremonium potronii* Vuill. [*R.A.M.*, xv, p. 20] but here renamed *Cephalosporium potronii* (Vuill.) Oomen on the basis of a thorough systematic comparison of a number of specimens of both genera. On peptone malt agar the fungus forms dull pink, pulverulent, fluffy colonies, later turning yellow to dark brown with radial and tangential folds. The aspect of cultures on other malt media, including Sabouraud's proof agar, is similar. Microscopic examination reveals the presence of roughly flask-shaped conidiophores, 10 to 80 μ in length and 1 to 2·3 μ in diameter, bearing shiny heads, 10 to 33 μ in diameter, composed of numerous oval conidia, 4 to 5 by 2 to 2·3 μ. These fructifications are often replaced by irregular arthrospores and large, thin-walled, yellow chlamydospores among the yellowish-brown mycelium. This is believed to be the first record of a *Cephalosporium* in the internal organs.

MATTICK (A. T. R.), HISCOX (E. R.), & DAVIS (J. G.). **Biennial reviews of the progress of dairy science. Section B. Bacteriology and mycology applied to dairying.**—*J. Dairy Res.*, viii, 3, pp. 369–405, 1937.

Among the many references of bacteriological and mycological interest in this review of two years' progress in dairy science [*R.A.M.*, xv, p. 154], besides Vernon's studies on butter defects, already noticed from other sources [ibid., xvi, p. 536], the following may be mentioned. Ause and Macy (*Amer. Cr. Poult. Prod. Rev.*, lxxix, p. 190, 1934) found no correlation between the numbers of *Oospora lactis* and the keeping quality of butter after storage [ibid., xv, p. 440], but this organism was found to be capable of destroying the flavour of fine starter butter. The same fungus was shown to be associated with the production of the typical flavour of Camembert cheese. A bibliography of 368 titles is appended.

CICCARONE (A.). **Su un attacco di 'Botrytis cinerea' Pers. a 'Hibiscus sabdariffa' Linn.** [Notes on an attack by *Botrytis cinerea* Pers. on *Hibiscus sabdariffa* Linn.]—*Riv. Pat. veg.*, xxvii, 9–10, pp. 265–274, 3 figs., 1937.

The author states that in November, 1936, *Hibiscus sabdariffa* plants in the Botanic Garden of Palermo, Sicily, were severely attacked by *Botrytis cinerea*, which caused diffuse, yellowish, later leaden-coloured spots on the leaves, resulting in the premature death and fall of the latter; it also killed the flower buds on affected plants, from which it spread to the branches and main stems, forming on these dark-coloured, depressed lesions; in severe cases the main stems were completely girdled by the fungus and collapsed. Isolations yielded a strain of *B. cinerea* which in further studies was shown to belong to the freely sporing

('conidial') group of the organism [*R.A.M.*, viii, p. 528]. Single spore subcultures were proved in inoculation tests to be highly pathogenic to *H. sabdariffa*, but not to the rose, cotton, potato, or tomato. In paired cultures no fusion was observed between the mycelium of the *Hibiscus* strain and that of a saprophytic strain isolated from rose fruits.

Röder (K.). **Phyllosticta cannabis (Kirchner?) Speg. eine Nebenfruchtform von Mycosphaerella cannabis (Winter) n.c.** [*Phyllosticta cannabis* (Kirchner?) Speg., an imperfect reproductive stage of *Mycosphaerella cannabis* (Winter) n.c.]—*Z. PflKrankh.*, xlvii, 10, pp. 526–531, 4 figs., 1937.

The stems of hemp plants from three different parts of Germany were found in the summer of 1936 to be infected by *Phyllosticta cannabis* [*R.A.M.*, xvi, p. 749], which is normally confined to the foliage. The material from two of the localities further bore large numbers of dark brown, applanate-spherical perithecia, 90 to 180 μ (average 135 μ) in diameter, rupturing the epidermis by means of a short papilla and occupied by up to 140 asci, 65 to 85 by 9 to 10 μ (75 by 9·5 μ), containing eight hyaline, bicellular spores, 11 to 17 by 4·5 to 8 μ (13·6 by 5·4 μ), which germinate in 14 to 24 hours at 24° C. The perithecia are scattered over the stem but the round or oval pycnidia, the former measuring 100 to 250 μ in diameter (average 175 μ) and the latter 150 to 225 by 90 to 120 μ (180 by 100 μ), are restricted to the discoloured (dark brown or black) tissues. The dimensions of the hyaline, elongated-oval, often slightly curved pycnospores in nature are 3 to 7 by 1·5 to 3·5 μ (5·1 by 2·3 μ); in culture they are a little larger. Germination is accomplished in 16 to 24 hours at 24°. Smooth, thick-walled, brown chlamydospores, elongated or round in nature, commonly the latter in culture, 8 to 17 μ in diameter (average 12 μ), develop in profusion in the vicinity of the pycnidia. Lupin stems and barley ears proved to be the most satisfactory media for perithecial development from single ascospore cultures; on Brown's starch, potato juice, and oatmeal agars, rice, elm wood, and potato stems, perithecia were less abundant but the typical pycnidia and chlamydospores of *P. cannabis* were formed. Both perithecia and pycnidia developed indifferently from the pycno- and ascospores obtained in pure culture, and monospore cultures of the chlamydospores and pycnospores occurring in nature each yielded pycnidia and chlamydospores but did not have the capacity of forming perithecia. Evidence is thus furnished of the genetic connexion between the perfect and imperfect stages of the hemp pathogen; the former should henceforth be known as *M. cannabis* (Winter) n. comb. (syn. *Sphaerella cannabis*). A Latin diagnosis of both stages is given.

Ulbrich (E.). **Ein neuer Fall von 'Alloiophyllie' bei Anemone nemorosa.** [A new case of 'alloiophylly' in *Anemone nemorosa*.]—*Verh. bot. Ver. Brandenburg*, lxxvii, pp. 86–89, 1 fig., 1937.

Attention is drawn to a fresh case of alloiophylly in *Anemone nemorosa* [*R.A.M.*, xvi, p. 130], the leathery consistency of the foliage being reminiscent of *Helleborus* leaves while the few flowers produced attained the size of peony blossoms. Both normal and diseased shoots may arise from the same rhizome. The presence of *Puccinia fusca* on

one of the affected plants is considered to be without etiological significance, and the same applies to the occasional association of *Urocystis anemones* [ibid., x, p. 600] with alloiophylly. The condition appears to occur indiscriminately on moist and dry soils, but it is noteworthy that all reports have so far emanated from woodland areas. This is the first record for the Mark Brandenburg.

Böhmig (F.). **Ueber die Anfälligkeit der Chrysanthemum-Sorten.** [On varietal susceptibility in Chrysanthemums.]—*Blumen- u. PflBau ver. Gärtenwelt*, xli, 44, p. 510, 1937.

The summer of 1937 afforded a favourable opportunity for the observation of varietal reaction in chrysanthemums to three leaf diseases, rust [*Puccinia chrysanthemi*: *R.A.M.*, xvi, p. 465], mildew [*Oidium chrysanthemi*: loc. cit.], and *Septoria* [? *chrysanthemella*: loc. cit.]. Highly susceptible to rust and *Septoria* were Madame Bringuier, Ondine and its sport Zitron, Allpink, and Dühmke's white and yellow (early propagation only), while mildew was severe on American Beauty, Perle von Vierlanden, Golden Seal, Rose Chochod and its variant Edmonton White, and Bronze Enton [*sic*] Beauty (also for early propagation). The following were practically free from all three diseases: Printemps d'Amour, Monument, Roi d'Or, Le Centenaire, the Ashes, Herbstglut, Madeleine Morin, Baldock's Crimson and its sport Algore's Yellow, Sprite, Phoenix, and Catriona.

Tompkins (C. M.) & Tucker (C. M.). **Foot rot of China-Aster, annual Stock, and Transvaal Daisy caused by Phytophthora cryptogea.**—*J. agric. Res.*, lv, 8, pp. 563–574, 4 figs., 1937.

In addition to causing foot rot of China aster (*Callistephus chinensis*), *Phytophthora cryptogea* [*R.A.M.*, xv, p. 156] has also been found in California causing a similar disease of the annual stock (*Matthiola incana* var. *annua*) and Transvaal daisy (*Gerbera jamesonii* var. *transvaalensis*), characterized by a very sudden wilt of the infected plants. The soft, wet rot involves the roots and lower portions of the stems of the China aster and annual stock, and the roots and crown of the Transvaal daisy, and is rapidly lethal. Excessive moisture, poor soil drainage, and cool weather favour the development of the disease. The strains of *P. cryptogea* isolated from the three hosts were indistinguishable in pure culture, but in cross-inoculation experiments the isolate from the Transvaal daisy was pathogenic to the annual stock but not to China aster, that from the annual stock infected China aster and Transvaal daisy, and that from China aster was pathogenic to the other two species and also to cucumber seedlings and young plants of wallflower (*Cheiranthus cheiri*) and Michaelmas daisy (*Aster* spp.), as well as to unwounded fruits of eggplant, ripe tomato, green chillies (*Capsicum annuum* var. *grossum*), pumpkin, watermelon, and cucumber.

From a group of diseased Transvaal daisy plants at Burlingame, California, showing symptoms indistinguishable from those of *P. cryptogea*, pure cultures of *P. drechsleri* were consistently isolated which, when inoculated into healthy Transvaal daisies, reproduced the typical disease symptoms.

Creager (D. B.). **Phytophthora crown rot of Dogwood.**—*J. Arnold Arbor.*, xviii, 4, pp. 344–348, 1 pl., 1937.

The results of the author's investigation, started in 1934, of a serious crown rot of the flowering dogwood tree (*Cornus florida*) planted on lawns and in gardens in Long Island showed that it is caused by *Phytophthora cactorum*. The disease, which usually leads to the disfiguration and ultimately to the death of the tree, is characterized by a severe die-back of the crown associated with defoliation; the leaves are few, small, and chlorotic and the affected trees usually bear an abnormal abundance of fruit several years before being killed. The seat of the disease is a necrotic lesion at the crown, at first quite obscure but gradually, as the lesion increases, the bark ruptures and the sap oozes in form of slime-flux. The bark over the older areas dies and is shed, and internally the diseased tissues are markedly discoloured, the affected area revealed on the removal of the bark having the shape of a parabola with a characteristically zonate surface. These zonations mark the different periods of the growth of the pathogen, and the lesion involves the greater part of the crown before the tree eventually dies.

P. cactorum was consistently isolated from the lesions of affected crowns. Pathogenicity was determined by inoculation tests made on seedlings in the greenhouse, the inoculum being inserted through an incision at the soil surface. At the end of seven weeks 16 of the 25 plants inoculated were dead whereas all the control plants remained healthy. Inoculation tests on larger trees in the field gave similar results.

Fron (G.). **L'emploi en horticulture des sels de quinoléine.** [The use of quinoline salts in horticulture.]—*Rev. hort., Paris*, cix, 22, pp. 647–649, 1 fig., 1937.

The use of cryptonol (ortho-oxyquinoline sulphate) [see above, p. 166] for the control of carnation wilt (*Fusarium dianthi*) is now standardized in France [*R.A.M.*, xv, p. 584] as follows. The cuttings are immersed for 12 to 24 hours in a 1 in 25,000 solution of the fungicide, and after planting out are regularly watered, together with the surrounding soil, with a 1 in 10,000 solution. On transference to the greenhouse (after the removal of any diseased individuals) the plants are again sprayed with cryptonol (1 in 25,000). The preparation has also given excellent results in an obscure disorder of vine grafts involving a heavy reduction of germination.

Fritz (F.). **Beiträge zur Pathologie der Zellmembran.** [Contributions to cell membrane pathology.]—*Z. PflKrankh.*, xlvii, 10, pp. 532–541, 9 figs., 1937.

Part I of this paper deals with the partial or total resorption of the membranous lamella enveloping the lumen of dead epidermal cells of *Tradescantia purpusi* by the adjoining living cells. In part II the author describes the recent detection, in fern prothalli in pure culture on fragments of peat or 2 per cent. agar, of a fungus presenting close analogies with *Completaria complens* Lohde, observed by W. Leitgeb over fifty years ago under similar conditions (*S.B. Akad. Wiss. Wien*, Abt. I,

lxxxiv, p. 288, 1882). At the sites of infection the penetrating hyphae are enveloped by the host cell in a cellulose substance, so that tubes or short 'fingers' arise connecting the opposite cell walls. These abnormal structures accumulate large quantities of vagin.

SCHULTZ (H.). **Vergleichende Untersuchungen zur Ökologie, Morphologie und Systematik des 'Vermehrungspilzes'.** [Comparative studies on the ecology, morphology, and systematic position of the 'propagation fungus'.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 1–41, 20 figs., 1937.

This is an exhaustive, fully tabulated account of the writer's studies on the ecological, morphological, and taxonomic relations of a number of strains of the so-called 'propagation fungus' (usually referred to *Moniliopsis aderholdi*), which is prevalent in German horticultural establishments [*R.A.M.*, xvi, p. 677]. The results of soil inoculation experiments in the greenhouse (mean temperature 20° C., atmospheric humidity 70 to 100 per cent.) on cuttings showed that the fungus produces different symptoms according to the nature of the host. *Hydrangea hortensis*, for instance, nearly always reacts by a damp stem rot involving rapid collapse, as also for instance do *Coleus blumei*, *Salvia splendens*, and Gloire de Lorraine begonias. In the case of *Santolina chamaecyparissus* and *Chrysanthemum indicum* the stem base usually remains free from infection, which sets in higher up. In *Campanula isophylla* and *Pilea nummularifolia* the fungus commonly starts from the foliage. In similar tests on seedlings yellow lupins (*Lupinus luteus*) were severely attacked by a number of strains of the propagation fungus, whereas comparative trials with some strains of *Rhizoctonia* [*Corticium*] *solani* K. from potato [ibid., ix, p. 739] mostly resulted in little or no damage. Both Neger and Wachs Flageolet beans (*Phaseolus vulgaris*) were much more resistant to the propagation fungus than lupins.

Of the various crucifers tested (white and red cabbage, kohlrabi, radish, and wallflower) only the first-named (Late Brunswick) showed appreciable resistance. Among the most virulent strains of the organism were those originating on crucifers, which caused complete destruction of the embryo. Lettuce (Maikönig) proved highly resistant and Danish Export tomatoes relatively so on the whole. Tests on Odenwälder Blaue potatoes showed that both the propagation fungus and *C. solani* K. are equally pathogenic, so that Wellensiek's proposal to maintain the name *M. aderholdi* as distinct from *C. solani* on the grounds of differential pathogenicity to tomato and potato [ibid., v, p. 193] cannot be upheld. As in the case of cabbage, strains originating on potato exhibited a marked degree of pathogenicity towards the same host. In a series of tests designed to ascertain the correctness or otherwise of the common view that susceptibility to the propagation fungus declines with increasing age, only lettuce proved to be an exception to the rule, older plants being distinctly more susceptible than young ones.

Most of the strains under investigation fell into five groups according to their mode of forming hyphal anastomoses. Such fusions are freely formed between individuals of the same group but not between those of others. In general, members of the same fusion group also agree in respect of morphological characters and temperature relations. Apart

from the predilection of certain strains of the propagation fungus for a given host, as indicated above, biologic specialization *sensu stricto* cannot be said to exist within this plurivorous organism, which is probably widely distributed over the entire globe. It is further apparent from the results of these studies that *M. aderholdi* is merely a variety of *C. solani* and as such is no longer entitled to rank as an independent entity [ibid., xv, p. 586]. In the case of two of the five groups the perfect (*Hypochnus*) [*Corticium*] stage of the fungus developed, in the shape of hymenium, basidia, and basidiospores, in inoculation experiments on a number of hosts. The spore dimensions for three of the strains (from kohlrabi, lettuce, and chrysanthemum) were 10·21 by 5·71, 8·99 by 5·42, and 8·92 by 5·19 μ, respectively. On the basis of these results, the groups are designated as follows: I. *R. solani* K. var. *hortensis* n.var.; II. *H. solani* P. and D. var. *brassicae* n.var.; III. *H. solani* P. and D. var. *typica* n.var. ('potato group'); IV. *R. solani* K. var. *cichorii endiviae* Thomas [ibid., iv, p. 443]; and V. *R. solani* K. var. *fuchsiae* n.var.

LUDWIG (M.). **Lupinenwelke und ihre Bekämpfung.** [Lupin wilt and its control.]—*Dtsch. landw. Pr.*, lxiv, 41, p. 500, 1937.

The writer briefly summarizes the results of experiments in combating a form of lupin wilt due to *Fusarium vasinfectum* [cf. ibid., xvi, p. 539 and the next abstract] by (*a*) an intensified potash-phosphate and lime fertilizing schedule and (*b*) seed treatment with uspulun. Neither of these measures was successful in eliminating the trouble, which was confined to yellow lupins [*Lupinus luteus*] in the Zerbst [Anhalt] district.

RICHTER (H.). **Blatt-, Stengel- und Hülsenflecken an Lupinen.** [Leaf, stem, and pod spots on Lupins.]—*NachrBl. dtsch. PflSchDienst*, xvii, 10, pp. 77–80, 9 figs., 1937.

During 1937 sweet blue lupins (*Lupinus angustifolius*), chiefly in Mecklenburg and Pomerania, were severely attacked by a hitherto unknown disease, characterized by premature shedding (in the second half of July) of the leaves, which were found on examination to bear numerous circular to oval, bluish-grey to greyish-brown spots, from a pin's head to 4 mm. in diameter, sometimes surrounded by a narrow pale or yellowish-green marginal zone. The lesions may converge and assume irregular forms. Infection spreads from the older to the younger foliage. Only the pinnate leaves are involved at first, the petioles mostly remaining attached in a desiccated condition to the plants until the latter finally collapse. At an advanced stage of the disease, circular to oval, sometimes very slightly sunken, reddish-brown, gradually darkening, at first sharply delimited, later confluent spots, up to 5 by 3 mm., appear on the stems and pods. On the death of the plants the root system rapidly decays and is colonized by fungi, especially *Fusarium* spp., which may cause confusion with foot rot. The younger stem portions are more or less crooked and extraordinarily brittle, while the pods are described as 'breaking like glass'; they contain only a few undeveloped seeds, if any. In one affected stand visited by the writer the weight of a thousand seeds was only 118·25 gm. as compared with the normal average of 191.

Bitter lupins were occasionally observed to be affected by the disease, blue lupins are definitely prone to attack, but neither the white (*L. albus*) nor the yellow (*L. luteus*) has so far shown any sign of infection. *Macrosporium* [*Thyrospora*] *sarcinaeforme* [*R.A.M.*, xvi, p. 616] was consistently isolated from the tissues of the diseased leaf areas, but seldom developed in cultures from the stems or pods; a preliminary inoculation experiment with this fungus on *L. angustifolius* gave positive results.

Brown spot disease (*Ceratophorum setosum*) [ibid., xiii, p. 166; xvi, p. 636], though previously observed in Germany, occurred for the first time in a virulent form on white lupins, causing the formation on the pods of extremely irregular, chestnut- to dark chocolate-brown, flat, slightly protuberant, or depressed and concentrically zonate lesions, 1 to 3 cm. in diameter, sharply delimited or merging by means of a light brown margin into the healthy tissue. On old plants in a damp atmosphere the typical conidia develop in the form of coal-black strata on the affected areas. In the case of late infection the spots are confined to the pods and the seeds remain healthy, but where the pathogen gains early ingress it passes to the seeds, causing brown spotting, and may readily be isolated from them. On the foliage the lesions also vary in size, shape, and colour; affected leaves are prematurely shed but on the whole the course of the disease is slower and its effects less harmful than in the case of *T. sarcinaeforme*. Needle-prick inoculations, however, resulted within three days in the development of lesions 1 cm. in diameter on green *L. albus* pods, while *L. mutabilis* also contracted infection fairly rapidly. The pathogen produced much milder effects on blue and yellow lupins and beans (*Phaseolus vulgaris*) but apple fruits developed brown, necrotic areas, 1 cm. in diameter, 13 days after inoculation. *L. mutabilis* and some other New World types also showed flower infection in the shape of brownish, necrotic spots on the petals which did not, however, appear to cause any actual damage. The following species were attacked at the Dahlem Biological Institute: *L. mutabilis*, *L. cruckshanksii*, *L. elegans*, *L. hartwegii*, *L. pulcherrimus*, *L. ornatus*, *L. micranthus*, *L. pubescens*, *L. albifrons*, *L. arboreus*, and *L. polyphyllus*; in contrast to *L. albus*, in which the pods are the most susceptible organs, these types showed almost exclusively foliar infection. *C. setosum* was also reported during 1937 from Neumark, Landsberg-an-der-Warthe, Havelland [Brandenburg], and East Prussia.

RUDORF (W.). **Untersuchungen zur Züchtung von kleekrebsresistenten Kleearten und Luzerne. Ausarbeitung von Infektionsmethoden. Vorläufige Mitteilung.** [Investigations on the breeding of Clover species and Lucerne resistant to Clover stem rot. Elaboration of infection methods. Preliminary communication.]—*Züchter*, ix, 10, pp. 249–253, 12 figs., 1937.

In studies at the Kaiser Wilhelm Plant Breeding Institute in Müncheberg, Mark Brandenburg, the author found that the best method for obtaining a large amount of inoculum of *Sclerotinia trifoliorum* [*R.A.M.*, xvii, p. 114] for clover inoculation experiments is to culture the fungus on small bread rolls, soaked in plum juice or clover leaf decoction; masses of sclerotia are produced and the rolls are then dried and ground to a

powder which is sprayed in a suspension on the leaves of the test plants. Another method is to inoculate ripe tomato fruits with the fungus and to use the pulp, which becomes permeated with mycelium, after dilution, as a spray on the test plants. Clover plants are stated to be easily infected with conidia of *S. trifoliorum* [no macroconidial stage of this fungus has yet been reported] obtained in considerable quantities from clover leaves inoculated with the fungus and kept in Petri dishes in the presence of moist blotting paper. Conidia are also stated to be profusely formed in old cultures on dextrose peptone agar. So far resistance tests on seedlings in a saturated atmosphere have indicated the presence of resistant individuals, which withstood three consecutive inoculations, in the Lembkes, Fränkischer, Schleswig, Dregers Böhmische zweischürige, Merkur, Ultuna, and Tystofte No. 40 clovers.

Braid (K. W.) & Tervet (I. W.). **Certain botanical aspects of the dying-out of Heather (Calluna vulgaris, Hull.)**—*Scot. J. Agric.*, xx, 4, pp. 365–372, 2 figs., 1937.

A fungus with black, horsehair-like rhizomorphs found to be associated with the dying-off of heather in Scotland was shown by comparative studies to bear a close resemblance to *Marasmius equicrinis* [*R.A.M.*, xvi, p. 798], both organisms being characterized by a thick-walled, spiral 'cortex' and a large, thin-walled 'medulla', while an affinity with *M. androsaceus* (a specimen of which from heather is included among Crossland's Yorkshire fungi) is also indicated. Other fungi occurring on heather in Scotland are *Dasyscypha nivea* (prevalent on dead and dying heather but so far there is no proof that it is actively parasitic), *Armillaria mellea* [ibid., vii, p. 29; viii, p. 147], and *Corticium* sp.

The black hairs of the rhizomorph fungus, up to 3 in. long, arise from hyphal agglomerations at the leaf bases and leaf scars, or (under relatively dry conditions) from the basal stems. The larger rhizomorphs produce rectangular branches 1 in. or more in length. The results of inoculation experiments with the rhizomorph fungus on wounded and unwounded plants yielded no evidence of primary parasitism, but the widespread distribution of the organism on dying and dead heather suggests some etiological connexion with the disease. Low temperature alone does not cause the typical fox-red discoloration associated with dying-off, but may be of importance in combination with strong wind, sunshine, beetle (*Lochmaea suturalis*) infestation, and possibly fungal invasion.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlviii, 10, pp. 573–577, 6 figs., 1937.

These notes contain, *inter alia*, a brief account of brown patchiness of lawns, which is stated to have been troublesome in several districts of New South Wales in 1937. The condition, which may appear in small spots, but more usually extends into larger areas of irregular shape, and leads to the browning and death of the grass leaves, is caused by *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xvi, p. 681] and *Curvularia spicata*, to which all turf-forming grasses and more particularly bent grass (*Agrostis tenuis*) are susceptible. It can be controlled by watering the

affected areas with a solution of a mixture of 1·5 oz. each of mercuric and mercurous chloride in 50 galls. water, a volume sufficient for the treatment of 1,000 sq. ft.

WOLLENWEBER (H. W.) & HOCHAPFEL (H.). **Beiträge zur Kenntnis parasitärer und saprophytischer Pilze. IV. Coniothyrium and seine Beziehung zur Fruchtfäule.** [Contributions to the knowledge of parasitic and saprophytic fungi. IV. *Coniothyrium* and its relationship to fruit-rotting.]—*Z. Parasitenk.*, ix, 5, pp. 600–637, 3 figs., 1937.

In a brief introduction to this, the fourth instalment of this series [*R.A.M.*, xvi, p. 323], the authors state that they investigated the relationship of 12 species of *Coniothyrium* to fruit rots only because of the fact that representatives of this genus, which mostly includes only leaf parasites, have been recorded in literature on stored fruits, chiefly apples imported from America. In a detailed discussion of the taxonomy of the genus *Coniothyrium*, they state that the most reliable morphological characters are the size and shape of the spores which in the great majority of cases always remain unicellular, and only very occasionally may in some species develop a transverse septum, e.g., at germination. The slight variations observed in the shape and size of the conidiophores are not considered to be of systematic significance, any more than the differences in the size, shape, and constitution of the pycnidia. A very full taxonomic and morphological account with Latin diagnoses is then given of the 12 species studied including *C. platani*, *C. ulmeum*, *C. fuckelii* [*Leptosphaeria coniothyrium*], *C. concentricum*, *C. tirolense*, and *C. pusillum* Wr. n. sp., which was found occasionally attacking the leaves of *Primula veris*. With the possible exception of *C. tirolense*, isolated in Berlin from imported apples and from dead twigs of *Juglans mandschurica* growing in the Botanic Garden, Dahlem, which caused a fairly rapid rot of apples and tomatoes, none of the other species tested proved to be an aggressive pathogen to these two species of fruits.

ATKINSON (J. D.). **Wound dressings for fruit-trees.**—*N.Z. J. Sci. Tech.*, xix, 5, pp. 313–316, 3 figs., 1937.

Recent observations having shown that the vertical-retort coal tar at present available on the New Zealand market does not afford adequate protection against the entry of pathogens through wounds on fruit trees (e.g., *Stereum purpureum* on peach), a series of experiments was carried out in the Hastings district in 1935 on Sturmer and Dougherty apple trees to determine the comparative value as wound dressings of coal tar, creosote, bitumistic paint 'colasmix' (a proprietary bitumen emulsion derived from crude petroleum containing 55 per cent. bitumen, 2 per cent. of a casein type emulsifier, and less than 0·2 per cent. injurious water-soluble potassium salts), white lead paint (Brooks's formula: 2 lb. white lead paste, 1 fluid oz. turpentine, 1 fluid oz. raw linseed oil, and $\frac{1}{4}$ oz. cobalt drier), and Chavostelon's formula (equal parts of 6 per cent. aqueous solutions of copper sulphate and potassium bichromate). Of these materials only 'colasmix' gave completely satisfactory results; nearly $1\frac{1}{2}$ years after application callus formation was proceeding rapidly and the wounds showed no sign of damage from the

dressing. Most of the white lead had flaked away, but the treated wounds had formed a moderate amount of callus.

HUS (P.). **De economie van de bespuitingen in de fruitteelt.** [The economics of spraying in fruit culture.]—*Tijdschr. PlZiekt.*, xliii, 10, pp. 227–237, 1937.

The writer discusses the economic aspects of five important problems connected with spraying against diseases and pests in Dutch orchards, viz., how often and at what intervals to apply the treatments, what disinfectants to use, the best spraying apparatus, the advisability or otherwise of incorporating 'wetters' with plant-protectives (the use of which is strongly recommended), and the advantages and drawbacks of the co-operative system as opposed to independent action on the part of individual growers.

WENZL (H.). **Eine neue Blattfleckenkrankheit auf Apfel, Doucin und Paradies in Österreich (Entomosporium maculatum Lév.).** [A new leaf spot of Doucin and Paradise Apples in Austria (*Entomosporium maculatum* Lév.).]—*Neuheiten PflSch.*, xxx, 5, pp. 199–202, 1937.

The prevalent leaf spot of free quince and pear stocks caused by *Entomosporium maculatum* (*Stigmatea mespili*) [*Fabraea maculata*: *R.A.M.*, xv, pp. 103, 427; xvi, p. 327] has recently been observed to have spread to several apple varieties, including Doucin and Paradise stocks, this being a new record for Austria. The fungus is further spreading extensively from quince to pear in Lower Austrian nurseries. Most of the conidia both from quince and pear are uniseptate, with occasional non- and triseptate individuals, and local observations lend no support to Laubert's theory of biologic specialization within the species [ibid., iii, p. 216].

BORZINI (G.). **Sul comportamento di alcune varietà di Peri inoculate con lo 'Stereum purpureum' Pers.** [On the behaviour of some Pear varieties inoculated with *Stereum purpureum* Pers.]—*Boll. Staz. Pat. veg. Roma*, xvii, 2, pp. 201–205, 2 figs., 1937.

In continuation of his studies on silver leaf disease (*Stereum purpureum*) [*R.A.M.*, xvi, p. 543] of pears the author states that the results of inoculation tests with the fungus on different varieties demonstrated that the Passa Crassana variety is the most susceptible, being killed within seven or eight months. Beurré Diel showed some symptoms of infection but the disease did not develop, whereas Beurré Clairgeau and Abate Fêtel were completely resistant. The attention of growers is directed to the necessity of testing experimentally the susceptibility of new varieties before planting them on damp soils likely to induce infection with *S. purpureum*.

VAN DER PLANK (J. E.) & DAVIES (R.). **Temperature—cold injury curves of fruit.**—*J. Pomol.*, xv, 3, pp. 226–247, 14 graphs, 1937.

This is stated to be an interim report, pending the publication of fuller accounts, of the general conclusions arrived at by the authors in their work at the Low Temperature Research Laboratory, Capetown,

on the interrelation of temperature and physiological breakdown of various fruits in cold storage, with particular reference to breakdown of plums, woolliness of peaches, and pitting of Marsh grapefruit [cf. *R.A.M.*, xvi, p. 807 *et passim*]. Within the range of the temperatures tested (30° to 55° F.) it was found that the most extensive amount of injury during relatively short periods of storage (25 days) occurred at the intermediate temperatures, with a falling-off at the higher or lower temperatures, so that usually the injury temperature curves show a peak. Two opposing factors appeared to be responsible for this peak, namely, (1) an equilibrium factor, expressed by lowering of the temperature increasing the disposition of the fruit towards injury, and (2) a kinetic factor, expressed by rising temperatures accelerating the manifestation of injury, indicating a process governed by the thermochemical rule that the rate of change is reduced as temperature is lowered. The temperature of maximum injury is essentially labile, and may occur above or below the freezing point of the fruit; it is not, however a fixed characteristic of the latter. For Marsh grapefruit a gradation was shown from a peaked to an incomplete curve without a demonstrable peak. The temperature of maximum injury was further shown to be lowered by (*a*) greater resistance of the fruit, (*b*) long period of storage, and (*c*) a faster rate of manifestation of injury.

When the period of storage was lengthened, the number of fruits injured did not increase indefinitely, but attained a 'maximum' which was sufficiently definite to be considered as a first approximation. The number injured was largest when the maximum was reached at the lowest temperatures, but the maximum was attained soonest at the highest temperature. This suggests that when a sample of fruit is stored at a constant temperature, a portion of the sample, depending on the susceptibility of the fruit, is out of equilibrium from the very instant of cooling (primary susceptibility), and subsequently develops injury, while the remainder is in a state of healthy equilibrium, as far as cold injury processes are concerned, and continues in this state indefinitely. While at present no known method exists of following the course of the chemical processes resulting from disequilibrium with the storage temperature, which eventually produce visible symptoms, the temperature coefficient (Q_{10}) of these processes may be determined for a given sample from the time taken by it to reach maximum injury. Frequency distribution curves of the 'primary susceptibility' of a population of fruit over a range of storage temperatures can be prepared, and it is shown that the efficacy of any measure calculated to reduce primary susceptibility may be measured in terms of shifting the frequency distribution curves of susceptibility down the temperature axis. In certain cases, however, a 'secondary susceptibility' can develop in fruit owing to changes that occur in it during storage, but injury due to primary and secondary susceptibility can be allocated separately. Various fruits may sustain only the one or the other, or both together. The factors predisposing fruit to secondary susceptibility do not appear to be directly related to those causing primary susceptibility. In conclusion the simple scheme of analysis suggested is applied to the data of Kidd and West on cold injury of apples [ibid., xiv, p. 41] to illustrate the amount of information which may be secured by this means.

Zeller (S. M.). **Two Septoria leaf-spot diseases of Rubus in the United States.**—*Phytopathology*, xxvii, 10, pp. 1000–1005, 2 figs., 1937.

A comparative study of the imperfect stages of the fungi associated with *Rubus* leaf spots in various parts of the United States and in England has necessitated a critical revision of the taxonomic position of two organisms liable to confusion in nature, viz., *Septoria rubi* West. var. *brevispora* Sacc., which is renamed *S. brevispora* (Sacc.) Zeller, and *S. rubi* West. *S. brevispora* produces angular, zonate spots, 1 to 2 mm. in width, cinnamon-brown near the margin, light pinkish-cinnamon within, turning light brownish-grey, usually not encircled by a purplish- or reddish-brown zone merging into the healthy tissue, as in the case of *S. rubi*. The fungus is characterized by brownish, broadly ostiolate pycnidia (5 to 18, average 10·4 per lesion), 46 to 60 μ in width, 27 to 35 μ in height, producing from the base only cylindrical, hyaline, uni- to triseptate spores, 15 to 30 (or up to 36) by 1·8 to 3·4 μ. The brownish-red, later whitish, purple-bordered spots formed by *S. rubi* are 0·5 to 1·5 mm. in width and bear only 1 to 7 (average 2·2) brownish-black, oblate-depressed, thin-walled, summer pycnidia, 80 to 100 μ in width, 75 to 85 μ in height, with a fairly narrow, somewhat rostrate ostiole, and produce both basally and laterally filiform uni- to pluriseptate, hyaline spores, 20 to 55 by 1·5 to 2·5 μ. The winter pycnidia of this species are characterized by heavy, dark walls, 3 to 4 cells thick, and an ostiole with no rostrate tendency. *S. rubi* predominates in Oregon and elsewhere along the Pacific Coast and *S. brevispora* in Maryland, Wisconsin, New York, and North Carolina. Generally speaking, raspberries and *R. strigosus* are highly susceptible to *S. brevispora* and resistant to *S. rubi*, while blackberries are subject to infection by both.

The question of the perfect stage of *S. rubi* presents considerable difficulty. *Mycosphaerella rubi* [ibid., xv, p. 163] was described by Roark from specimens collected in Door County, Wisconsin, and nothing resembling it has been observed in Oregon. On the other hand, *M. ligea* is prevalent in Oregon on green overwintering or fallen leaves of Himalaya, Logan, and Evergreen (*R. laciniatus*) blackberries where the European type of *S. rubi* occurs, suggesting a genetic connexion which has not, however, been confirmed by cultural experiments. The perfect stage of *S. brevispora* has not been observed by the writer.

Stahel (G.). **Notes on Cercospora leaf spot of Bananas (Cercospora musae).**—*Trop. Agriculture, Trin.*, xiv, 9, pp. 257–264, 8 pl., 1937.

This is a full report of the author's investigations of the leaf spot of bananas (*Cercospora musae*) in Surinam, a preliminary summary of which has already been noticed [*R.A.M.*, xvi, p. 545]. In addition to the information previously given, it is stated to have been shown by cultural experiments on portions of leaf tissue that the spermogonia present on dry leaf spots belong to the life-cycle of *C. musae*. These bodies, which on the average measure about 50 μ in diameter (but may attain 90 μ), originate in the substomatal air chambers and open immediately under the stomatal pores. The spermatia, which were never observed germinating, measure 3·5 to 4 by 0·8 μ, and are formed in long, straight chains. Of the two kinds of perithecia constantly found on the

spots, the most common is that of a species of *Leptosphaeria*, which is believed to be probably identical with *L. musarum* [ibid., xv, p. 487]. Pure culture studies showed that this fungus is genetically identical with the species of *Hendersonia*, previously reported, the pycnidia of which are also constantly present on the banana leaf spots, but not with *C. musae*. The other kind of perithecia belongs to a species of *Mycosphaerella*, quite distinct from *M. musae* [ibid., viii, p. 25]; it is considered to be new to science, and is named *M. minima* [without a Latin diagnosis]. In pure culture its mycelium is hyaline at first, but later turns brown; it grows slowly and in twisted fashion, and no conclusion could be reached in regard to its genetic relationship to *C. musae*, which for the most part exhibits markedly stronger but somewhat similar growth. Spraying experiments carried out by the Surinam Banana Company during 2½ years show that the cost of one application is $1·75 per acre. The motor sprayer is mounted on a boat which is easily moved to all parts of the empoldered plantations. Bayer fungicide with an adhesive is now used in place of Bordeaux mixture as it involves less labour.

[A Dutch version of this paper is published as *Bull. Dep. Landb. Suriname*, 53, 27 pp., 1937.]

WARDLAW (C. W.). **Banana diseases. XI. Notes on some plantation diseases in Guadeloupe.**—*Trop. Agriculture, Trin.*, xiv, 10, pp. 279–280, 1937.

The author states that in the Island of Guadeloupe (French Antilles) the main commercial banana is the Congo or Poyo, a mutant of the Cavendish group, with an occasional admixture of Gros Michel, Dwarf Cavendish, and other varieties. The diseases observed in the Congo variety include bacterial wilt (*Bacterium solanacearum*) [*R.A.M.*, xvi, p. 393], black tip (*Helminthosporium torulosum*) [ibid., xvi, p. 156], and leaf-spotting (*Cercospora musae*) [see preceding abstract]; leaf speckle (*Chloridium musae*) [ibid., xvi, p. 476] and a leaf spot caused by *Cordana* [*Scolecotrichum*] *musae* [ibid., xv, p. 705] were present but neither is of much importance. In one localized hillside area, planted with the Congo variety (possibly derived from one source), a complex form of disease was observed, comprising both virus markings on the leaves of a type similar to that already seen in Trinidad, Bermuda, and Brazil [ibid., xiii, p. 251], and an extensive type of heart rot of the youngest unrolled leaf and of the inner tissues of the pseudostem, which may progress downwards until the compact tissue of the rhizome is reached, at which point a sharp line of demarcation separates the healthy and the diseased tissues. The condition presents a striking similarity with the Australian infectious chlorosis [loc. cit.], and may eventually be proved to be identical with it. Destruction of infected stools *in situ* is advised. Panama disease (*Fusarium oxysporum cubense*) was found on the Gros Michel banana, but as this variety is not favoured on French markets the disease is not considered locally to be of economic importance.

GONÇALVES (R. D.). **Saporema.**—*Biologico*, iii, 10, pp. 302–305, 2 pl., 1937.

The author states that along the southern littoral of Brazil the name

'saporema' (vernacular for 'stinking root') is commonly applied to a root rot of bananas associated with species of *Rosellinia* and *Fusarium*, to a root rot of cassava associated with *Rosellinia* sp. [*R.A.M.*, xv, p. 278], which is at present under investigation, and also to peculiar sclerotial formations, the weight of which ranges from 3·5 to 28 kg., frequently found in banana and cassava plantations. Pieces of such bodies kept in moist, dark chambers, produced in two instances, after 15 and 5 months' incubation, respectively, sporophores apparently identical with those which were obtained in 1897 by Möller in Berlin-Dahlem from saporemas received from Brazil, and which he described under the name *Polyporus sapurema*. Experiments still in progress, in which fragments of the sclerotia were either introduced in, or left in direct contact with wounded banana pseudostems, have so far given no indication that the fungus is pathogenic to this host. The Australian fungus (*Laccocephalum basilapidoides*) described by McAlpine and Tipper in 1894 presents many points in common with the Brazilian organism.

THOMPSON (A.). **Pineapple fruit rots in Malaya. A preliminary report on fruit rots of the Singapore canning Pineapple.**—*Malay. agric. J.*, xxv, 10, pp. 407–420, 20 pl., 1937.

This is a full account of the author's studies of the three diseases of pineapple fruits in Malaya, namely fruitlet brown rot, broken core, and fruit collapse, associated with various bacteria and fungi. In addition to information already given [*R.A.M.*, xvi, p. 657] it is stated that the fruitlet brown rot is apparently similar to the disease recorded in the Philippines and Haiti [ibid., xiv, p. 456] and is also associated with an organism resembling *Erwinia ananas* [loc. cit.], often with another closely resembling *Phytomonas* [*Pseudomonas*] *ananas* [loc. cit.], and with a species of *Penicillium*.

Fruitlet brown rot appears to be more frequent in riper fruit and can be seen after removal of the outer layers of the fruit. It is characterized at an early stage by the brown discoloration of the top or of one or all the three placental lobes and though the rot is sometimes extensive it does not usually progress beyond the base of one or more of the ovarial loculi. It is often possible to cut out the diseased tissues and use the rest of the fruit for canning purposes. Preliminary inoculations with the associated organisms through wounds of half-grown fruits, or immature fruits which had finished flowering, gave negative results. However, in fruit inoculated when mature or in the flowering stage with the yellow *E. ananas* brown rot developed in 8 out of 36 cases and when *Penicillium* was used in 3 out of 12 cases. The author considers that development of the rot in the fruits inoculated when in flower might be the result of natural infection and further evidence is required to establish this mode of infection. Inoculations with three strains of white bacteria (one closely resembling *Pseudomonas ananas*) gave positive results in five cases, but the organisms could not be reisolated. The author concludes that the frequent isolation of *E. ananas* and *Penicillium* from diseased fruits and the results of the inoculation experiments recorded alone indicate that these organisms are implicated in

the development of the disease, but that their parasitic nature is doubtful, the rotting being influenced by certain internal and external factors which set up conditions favourable to the organisms concerned. Spraying is considered impracticable as a control measure, and more promising methods are the breeding of resistant strains and possibly the use of potash as fertilizer.

Broken core is of frequent occurrence in Malaya but has not been recorded elsewhere. It is characterized by ripening of the fruit from the top downwards, and often there may be a depression at the centre or a bending of the top to one side. It is sometimes accompanied by a saprophytic rot, which attacks the core or the tissues next to the core and renders the fruit unfit for canning. The cause of the disease has not yet been determined.

Fruit collapse appears to be confined to Johore where it was observed in 1935 affecting 2 per cent. of the fruit brought to the canning factories. Isolations from the diseased tissues yielded two species of bacteria, yeasts, and a species of *Fusarium*, but none has reproduced the disease on inoculation.

GREEN (E. L.) & GOLDSWORTHY (M. C.). **The copper content of residues from sprays containing adjuvants.**—*Phytopathology*, xxvii, 10, pp. 957–970, 1937.

In 1935 four, and in 1936 five spray mixtures with a copper phosphate [*R.A.M.*, xvi, pp. 391, 549] basis were applied to test blocks of Kieffer pears at the Beltsville (Maryland) Horticultural Field Station. All contained 2 lb. copper phosphate, 4 lb. hydrated lime, 2 lb. bentonite, and water to make 50 galls. One mixture contained no further ingredients, while the following adjuvants were incorporated with the others: (2) 4 oz. 'butylated diphenyl sulphonic acid'; (3) $\frac{2}{3}$ lb. of a synthetic resinous material blended with sodium oleyl sulphate [ibid., xvii, p. 123]; (4) 1 lb. of a special fish-oil soap; and (5) 1 qt. cottonseed oil per 100 galls. Samples of fixed areas of all the plots were taken at intervals from May to October and analysed for total copper content.

In 1935 the quantity of copper per unit area was not affected by any of the accessory substances within the fairly wide error of sampling, but in the drier season of 1936 all the adjuvants increased the initial deposit of copper, and at least two [from table 2 apparently fish-oil soap and cottonseed oil] measurably enhanced adhesion. Inconclusive data were obtained in regard to the control of leaf blight (*Fabraea maculata*) [see above, p. 188], against which the treatments were applied.

TRAPPMANN (W.). **Zur Kennzeichnung der Pflanzenschutzmittel.** [On the designation of plant-protectives.]—*Kranke Pflanze*, xiv, 10, pp. 165–169, 1937.

This is an appeal to German manufacturers of plant protectives for more frankness and accuracy in the designation of their preparations, the present haphazard system of describing which may lead to serious misconceptions as to the properties and uses of such substances.

Saint-Charles (R. de). **Bouillies adhérentes et mouillantes.** [Adhesive and wetting spray mixtures.]—*Rev. Vitic., Paris*, lxxxvii, 2256, pp. 227–229, 1937.

The author states that in his practical experience sulphonated terpenic alcohols [*R.A.M.*, xv, p. 819] gave full satisfaction in increasing the adhesive and wetting properties of the fungicidal and insecticidal sprays used for the control of vine diseases and pests, at concentrations of from 100 to 200 gm. per 100 l. spray. For fruit trees the strength should be somewhat increased, the actual amount being determined empirically by dipping a leaf of the species to be treated in the prepared mixture. He states further that when mixed with copper salts these alcohols have been experimentally proved in 1936 and 1937 to be effective against vine *Oidium* [*Uncinula necator*].

Quantz (J. J.). **Verbessertes Verfahren zur Dämpfung kleiner Erdmengen mit Futterdämpfern.** [An improved method of steaming small quantities of soil with fodder-steamers.]—*Blumen- u. PflBau ver. Gartenwelt*, xli, 41, pp. 475–476, 1 fig., 1 diag., 1937.

Details are given of an improved procedure based on Storck's method of sterilizing small quantities of soil by steam [*R.A.M.*, xii, p. 460], using a tip-cart holding 80 l. of soil fitted with a specially constructed fork (Kyffhäuserhütte, Maschinenfabrik, Artern, Saxony) and attached to the Nema fodder-steamer 120. The steam, generated in the latter, permeates the soil in the cart (connected by means of a tube) through openings in the prongs of the fork, and the necessary soil temperature of 95° C. should be reached in 25 minutes. It is estimated that 1·5 cu. m. of soil can be treated daily by this process.

Ve Congrès international technique et chimique des industries agricoles Schéveningue—1937. Comptes-rendus Volume I. Section 5. Maladies et parasites des plantes industrielles. Question 4. Maladies des plantes. Défense contre ces maladies. Influence des éléments secondaires sur la production et l'état sanitaire des plantes industrielles. [Fifth International Technical and Chemical Congress of Agricultural Industries Scheveningen—1937. Proceedings Volume I. Section 5. Diseases and parasites of economic plants. Problem 4. Plant diseases. Protection against these diseases. Influence of minor elements on the production and state of health of economic plants.]—pp. 410–450, 457–488, 501–507, 5 figs., 7 graphs, 1937.

In a brief opening survey of the problems under consideration J. Dufrénoy outlines the principles of plant protection.

H. M. Quanjer sums up the position in regard to the alleged extension and aggravation of plant diseases by cultivation.

N. van Poeteren discusses the question of the need for chemical treatments against plant diseases and pests in course of extension, and concludes that such direct measures (as opposed to indirect control by breeding for resistance and the provision of optimal environmental conditions) are indispensable.

L. Roger draws attention to the need for the application of phytosanitary measures to tropical crops, such as coffee, cacao, *Hevea* rubber, cotton, and sugar-cane, the varieties of which under cultivation are

commonly selected for productivity rather than for an inherently robust constitution.

J. Dufrénoy briefly summarizes some outstanding recent studies on beet, sugar-cane, and cotton diseases, and gives an account of elements indispensable to healthy plant growth.

Experiments showing the relation of magnesium to the health of beets are described by G. Roland [*R.A.M.*, xvi, p. 649].

J. Baeyens gives a concise survey of the uses of the chief 'minor' or 'secondary' soil elements in agricultural plant physiology, in connexion with which the relegation of these important minerals to accessory rank is deprecated as illogical. Some suggestive general conclusions are drawn as to the characterization and physiological role of the 'rare' elements and the importance of an exact analytical and experimental technique in their investigation.

F. Lambermont describes the results of experiments in the control of beet leaf spot (*Cercospora beticola*) in Spain with Bordeaux mixture, copper oxychloride, and Burgundy mixture [ibid., xii, p. 416], of which the last-named in particular gave highly satisfactory results, augmenting the yield in certain cases by over 1 ton per hect.

Otero (J. I.) & Cook (M. T.). **A bibliography of mycology and phytopathology of Central and South America, Mexico and the West Indies.**—*J. Agric. P. R.*, xxi, 3, pp. 249–486, 1937.

This is a briefly annotated list, arranged alphabetically under the authors' names, of papers relating to the mycology and phytopathology of Central and South America, Mexico, and the West Indies.

Galloway (L. D.). **Paints and mould growth: causes and remedies described.**—*Paint Varn. Lacq. Manuf.*, vii, 10, pp. 317–318, 1937.

Among the moulds commonly found on paint [*R.A.M.*, xvi, p. 826] are dark-pigmented species of *Cladosporium*, including *C. herbarum*, *Phoma pigmentivora*, the agent of reddish-purple stains [ibid., xvi, p. 398], various green species of *Penicillium*, and under very damp conditions *Aspergillus* spp., such as *A. niger* and *A. flavus*, the latter being commonly reported from breweries. Factors conducive to paint mildew are a high relative humidity of the atmosphere (above 70 to 75 per cent.), an optimum temperature for fungal growth (25° to 30° C.), and the availability of nutrients, such as gelatine in glue, or casein emulsion, on water paints, and linseed in oil paints. A degree of control may therefore be exercised by the avoidance of these conditions, but in practice the most popular method of combating mildew is the use of an efficient antiseptic, among the more promising of which may be mentioned thymol, mercuric chloride (both 0·02 per cent.), *p*-chlor-*m*-cresol (0·05), sodium silicofluoride (0·15), salicylanilide (shirlan), *o*-chlormercuriphenol (0·01), and borax (1). Magnesium silicofluoride has been found useful for washing down plaster walls in damp situations where mildew is very liable to occur.

T. MacLachlan has recently shown that fungi are largely responsible for the blackening and decay of stone in large cities, where the relative scarcity of sunlight prevents rapid drying after rain and affords little opportunity for the beneficial action of ultra-violet rays.

KLEMM (M.). **Pflanzenschutzmeldedienst und Erzeugungsschlacht.** [Plant protection information service and production campaign.] *NachrBl. dtsch. PflSchDienst*, xvii, 9, pp. 69–70, 1937.

In order to co-operate effectively in the campaign for the intensification of agricultural production in Germany, the author advocates widening the scope of the plant protection information service considerably.

KÖGL (F.) & FRIES (N.). **Über den Einfluss von Biotin, Aneurin und Meso-Inosit auf das Wachstum verschiedener Pilzarten. 26. Mitteilung über pflanzliche Wachstumsstoffe.** [On the influence of biotin, aneurin, and meso-inositol on the growth of various species of fungi. Note 26 on plant growth substances.]—*Hoppe-Seyl. Z.*, ccxlix, 2–4, pp. 93–110, 2 graphs, 1937.

Certain Phycomycetes, Ascomycetes (e.g., *Nematospora gossypii* [*R.A.M.*, xvi, p. 199], *Lophodermium pinastri* [ibid, xvi, p. 847], *Nectria coccinea* [ibid, xvi, p. 645], and *Sclerotinia cinerea*), and Basidiomycetes (*Polyporus adustus* [ibid., xvi, p. 354] and *P.* [*Polystictus*] *abietinus* [ibid., xvi, p. 7]) were induced to grow or stimulated to exceptionally profuse development by the addition to a synthetic medium [the composition of which is indicated] of one or more of the growth substances biotin (the purified active principle of bios), meso-inositol, and aneurin. The growth of *Nematospora gossypii*, for instance, was augmented by the admixture of meso-inositol with or without aneurin at a dilution of $1{:}25 \times 10^{-10}$, the optimum concentration, however, being $1{:}25 \times 10^{-8}$. The results of further experiments denoted that certain fungi failing to respond to one or other of the above-mentioned substances produce sufficient quantities thereof to meet their own requirements. When *P. adustus* and *N. gossypii* were grown together on the synthetic medium, both were able to develop, the former apparently supplying biotin and the latter aneurin.

WALKER (J. C.), MORELL (S.), & FOSTER (H. H.). **Toxicity of mustard oils and related sulfur compounds to certain fungi.**—*Amer. J. Bot.*, xxiv, 8, pp. 536–541, 2 figs., 1937.

The toxicity of twelve [listed] volatile organic sulphur compounds to *Colletotrichum circinans*, *Botrytis allii*, *Aspergillus niger*, *A. alliaceus*, and *Gibberella saubinetii* has been studied, in view of the possible relation of these substances to disease resistance [*R.A.M.*, xiv, p. 553], by exposing the fungus in question to the vapour phase of the volatile oil in a closed chamber, and also to the volatile oils in solution. The oils were found to differ widely in their effect on a given fungus, and among the five fungi studied there was a wide range of sensitivity to a given sulphur oil. The type of radical attached to the nucleus of the organic molecule exerted an effect on the toxicity, in general the descending order of toxicity being allyl, phenyl, methyl, and ethyl. Isomeric substances may vary considerably as shown by the high toxicity of methyl isothiocyanate and the relatively low toxicity of methyl thiocyanate. Of the fungi studied *G. saubinetii* was the most sensitive, followed in order by *C. circinans* and *B. allii*, *A. alliaceus*, and *A. niger*. Allyl mustard oil showed extreme toxicity in the free state, but when present as the glucoside, sinigrin, the form it usually takes in plant

tissues, it manifests no toxicity. This substance may be expected to function in host resistance only when it is released as the free oil, and conclusions regarding the protective value of a toxic substance such as this based on gross chemical analyses may therefore be quite misleading.

Ovčarov [Ovtcharoff] (K. E.). **The production of thio-urea by fungi.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xvi, 9, pp. 461–464, 1937.

As a result of chemical analyses by a method which is described, the author states that thio-urea was experimentally shown to be produced in pure culture by certain fungi (*Fusarium* sp. of the *Gibbosum* section, *Verticillium albo-atrum*, and *Botrytis cinerea*) in the presence of asparagin and ammonium salts, but not of nitrates. Traces of thio-urea were also found in healthy *Rubus saxatilis*, *Alchemilla vulgaris*, and *Rhamnus cathartica* plants, while in plants of the same species infected with their respective rusts [unspecified] the amount of thio-urea was considerable, suggesting the secretion of this substance by the parasite into the host tissues. Further experiments indicated that an accumulation of thio-urea in the tissues of the higher plants leads to a lowering of their photosynthetic energy and to a yellowing and necrosis of the green leaves, though chlorophyll did not seem to be affected directly.

Baldacci (E.). **Nuove ricerche sulla 'vaccinazione' delle piante.** [Further studies on the 'vaccination' of plants.]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, x, 19 pp., 1937. [Latin and English summaries.]

Continuing his studies on plant 'vaccination' [*R.A.M.*, xv, p. 678; xvii, p. 55], the writer describes a series of experiments, yielding only inconclusive or negative results, on the immunization by this method of wheat and rice seedlings against *Helminthosporium sativum* and *H. oryzae* [*Ophiobolus miyabeanus*: ibid., xvi, p. 405; xvii, p. 61], respectively.

Schultz (E. S.). **Pathological phases of Potato wart disease.**—*J. econ. Ent.*, xxx, 5, pp. 721–723, 1937.

This is a concise summary of the available information on wart disease of potatoes (*Synchytrium endobioticum*), reference to the various aspects of which herein discussed has been made from time to time in this *Review*.

Sch. **Umstellung des Kartoffelbaues auf krebsfeste Sorten bis zum Jahre 1941.** [The reorganization of Potato cultivation with wart-immune varieties by the year 1941.]—*Dtsch. landw. Pr.*, lxiv, 43, pp. 525–526, 1937.

A brief outline is given of the rapid development of potato wart [*Synchytrium endobioticum*] in Germany [see next abstract] since its detection some 30 years ago, and of the attempts to combat the disease by the cultivation of immune varieties. By the Potato Wart Control Order of 8th October, 1937, the exclusive cultivation of officially recognized wart-immune varieties for seed is prescribed as from 1st March, 1941 [*R.A.M.*, xvi, p. 631], but during the interim certain susceptible varieties may be grown at the discretion of the administrative bodies

concerned [see below, p. 208], except on infected areas, where only immune sorts will be allowed. In order to facilitate the production of wart-immune planting stock for 1940–1, only potatoes of this category are to be placed on the market from 1st July, 1940, onwards.

Böhm (F.). **Der Weg einer Kartoffelzucht.** [The development of a Potato-breeding establishment.]—*Mitt. Landw., Berl.*, lii, 41, pp. 859–860, 2 figs., 1937.

An interesting account is given of the aims and activities of the potato-breeding establishment founded at Gross-Bieberau (Hesse) in 1900, with special reference to the development of varieties immune from wart (*Synchytrium endobioticum*: *R.A.M.*, xvi, p. 403], e.g., Ackersegen, Ovalgelbe, Mittelfrühe, Edelgard, and Sieglinde. An important feature of the work consists in the combination of the essential characters of productivity and immunity from wart disease with such desirable qualities as resistance to scab [*Actinomyces scabies*] and 'Eisenfleckigkeit' [ibid., xvi, p. 58]. The enterprise necessitates the annual testing of many thousand strains of various age groups, and those selected undergo extensive trials for wart reaction, productivity, and starch yield before being submitted to the Reich Food Board for further protracted testing.

Mammen. **Wichtige Knollenkrankheiten der Kartoffeln.** [Important diseases of Potato tubers.]—*Mitt. Landw., Berl.*, lii, 41, pp. 861–862, 1937.

With a view to increasing the German potato output, which is stated to amount to only 30 per cent. of the total world production, the writer gives a popular account of the symptoms, etiology, and control of some important diseases affecting the tubers, namely, scab [*Actinomyces scabies*], wart [*Synchytrium endobioticum*], and *Rhizoctonia* [*Corticium*] *solani*, followed by brief notes on the storage rots due to *Phytophthora infestans*, *Fusarium* sp., and bacterial agents.

Afanasiev (M. M.). **Comparative physiology of Actinomyces in relation to Potato scab.**—*Res. Bull. Neb. agric. Exp. Sta.* 92, 63 pp., 1937.

In this study on the physiology of parasitic and saprophytic species of *Actinomyces* [*R.A.M.*, xvii, p. 132] the author used 25 different cultures, 13 isolated from scabby potatoes in Nebraska (of which seven were parasitic), and 12 saprophytic strains obtained from different sources in the United States and abroad. Tests of cultures A–1, A–12, *A. clavifer*, *A. setonii*, 3369 (*A. viridis*), *A. tricolor*, and *A. xanthostroma*, reported by other workers to be parasitic, failed to show any pathogenicity. The seven parasitic strains produced scab of three types, viz., common, deep, and russet, and two or three of these types were often found on individual potatoes, the differences exhibited being due more to the degree of pathogenicity than of type, contrary to Millard and Burr's view [ibid., vi, p. 179]. Fickle midge larvae (*Sciara inconstans*), by feeding on the dead tissues of deep scab lesions, were observed to make them appear larger, but *A. scabies* is also capable of producing deep scab without the assistance of these or other larvae.

A tabulated account is given of experiments which were carried out

under comparable conditions on the ability of species of *Actinomyces* to utilize different carbon compounds; the results of tests of the parasitic and saprophytic species on different sources of carbon showed that the two groups are affected in the same way with the exception that all parasitic cultures are able to use sucrose and raffinose, whereas the saprophytes are unable to grow on them. On different nitrogen media growth of both parasitic and saprophytic species was similar except that practically all parasitic and some saprophytic strains failed to grow on media containing 0·5 per cent. of urea, due to the toxicity of ammonia formed as a product of the decomposition of urea. Further tests demonstrated that ammonium carbonate, ammonium bicarbonate, and ammonium hydroxide were also toxic because of the evolution of ammonia. Inhibition of growth caused by potassium bicarbonate and calcium hydroxide was greater in parasitic than in saprophytic species of *Actinomyces*, and the author believes that the growth failure of the parasitic cultures was due to the direct toxicity of these compounds rather than to their high alkalinity. The application of urea to sterilized soil previous to inoculation with parasitic *Actinomyces* reduces potato scab in proportion to the amount applied, and completely prevents scab when used at the rate of 0·5 gm. per 7 lb. soil. A pronounced difference in the effect on the development of aerial mycelium of parasitic and saprophytic cultures was found to be due to different carbon: nitrogen ratios, a high proportion of nitrogen inhibiting the production of aerial mycelium by the parasites but not by the saprophytic strains. All the parasitic and some of the saprophytic *Actinomyces* were able to produce melanin pigment on a tyrosine medium provided that other nitrogenous compounds were present. The ability of parasitic strains to utilize sucrose and raffinose, and to produce melanin pigment in a tyrosine medium, as well as their inhibition by ammonia, are important factors in differentiating them from many saprophytic species and may contribute towards finding some method for their control.

Goss (R. W.). **The influence of various soil factors upon Potato scab caused by Actinomyces scabies.**—*Res. Bull. Neb. agric. Exp. Sta.* 93, 40 pp., 1 fig., 1937.

In these studies on the effect of soil moisture, temperature, aeration, and soil microflora upon the occurrence of potato scab (*Actinomyces scabies*) [see preceding abstract] under partially controlled conditions in the greenhouse, emphasis was laid on the influence of these factors upon the development of *A. scabies* in the soil preceding the infection period. The severity of potato scab was found to be directly dependent upon the amount of inoculum in the soil, the latter being in turn dependent on the degree of competition of other soil organisms. The most severe infection took place when the soil was sterilized before inoculation, but this effect could be counteracted by the addition of filtrates from unsterilized soil or of organic matter in the form of manure, and by delaying inoculation until after saprophytic organisms had become established in the soil. No decrease in the severity of scab was observed when *A. praecox* was added to the soil in amounts approximately equal to that of *A. scabies* [cf. *R.A.M.*, vi, p. 684]. Sterilized soils, inoculated

with *A. scabies* and incubated at temperatures below 22° C., gave rise to less scab development than those incubated at 22° to 30°, whereas unsterilized soils did not show this effect.

The effect of soil moisture on the disease was variable, and although most scab occurred in dry soils, no effective control was indicated in a number of experiments with soils held at or near saturation point. The results of experiments on soil types indicated that caution should be exercised in comparing the effect of soil moisture in different soils; the largest amount of scab occurred in soils held at medium or high moisture contents for some months previous to planting, but no evidence was obtained that high soil moisture exerted any depressing effect upon the subsequent development of scab. No consistent relationship of numbers of *Actinomyces* to scab or to soil moisture was revealed in plate counts and soil slides; generally speaking, *Actinomyces* predominated in the drier soils, but the numbers were sometimes greatest in soils of high moisture content. An essential factor in the development of the disease was found to be soil aeration, and lack of it during the period preceding tuber formation produced a greater effect on the decrease of scab than deficient aeration during the period of infection.

SALAMAN (R. N.). **Potato variety production: a new departure.**—*Gdnrs' Chron.*, cii, 2653, pp. 326–327, 1937.

The two most important qualities to be aimed at by British potato-breeders are stated by the writer in this interesting sketch of the history of varietal production in England from 1600 onwards to be resistance to (1) blight (*Phytophthora infestans*) and (2) virus diseases. During the last ten years a number of seedling varieties have been developed combining blight resistance in both haulm and tuber with other desirable characters, the perpetuation of which, however, was complicated by the appearance in the Cambridge trial field of a new biotype or strain of the fungus attacking the resistant strains, though about a month later than the common domestic sorts, such as King Edward and Majestic. Resistance to this second form of blight, coupled with suitable commercial qualities, has gradually been built up, first by crossing the highly resistant *Solanum demissum* from Ecuador with the first line of resistant stocks and then back-crossing with domestic varieties such as Sutton's Abundance and Katahdin. New parental types are therefore now available for the further production of blight-resistant potatoes of a superior grade.

The resistance to the X virus claimed by American workers for their newly-developed variety [S] 41956 [*R.A.M.*, xvi, p. 630] has been confirmed in England, but on the whole the prospects of securing genetic resistance (as distinct from tolerance) to virus diseases are not encouraging. Further discussion of this problem is reserved for a future communication.

LUTMAN (B. F.). **Disinfectants and cut-seed Potatoes.**—*Bull. Vt agric. Exp. Sta.* 418, 36 pp., 4 pl., 13 figs., 1937. [Abs. in *Exp. Sta. Rec.*, lxxvii, 6, pp. 799–800, 1937.]

Five years' experimental work at the Vermont Agricultural Experiment Station demonstrated that formaldehyde is more injurious to cut

potato seed pieces than mercuric chloride, mercurous chloride, yellow mercuric oxide, or the organic mercury compounds, not merely penetrating the exposed parenchyma, but also progressing along the vascular bundles into the sprouts. Mercuric chloride solutions killed the seed pieces by coagulating the protoplasm, progress into the flesh increasing with the length of time the seed piece is kept; immediate removal of the coagulated layer reduces the penetration, which, if not removed, may kill the sprouts on planted seed pieces. Seed pieces disinfected with mercurous chloride generally germinate well, very little of the chemical being absorbed. The behaviour of yellow oxide of mercury [*R.A.M.*, xvi, p. 57] is similar. Cut seed pieces treated with organic mercury compounds are undamaged if dried immediately and completely. Cut tubers that are to be treated should be left in a damp, cool place for at least five days in order to regenerate a new skin, and should then be dipped in mercurous oxide, yellow oxide of mercury, or an organic mercury compound, preferably the last-named, and be promptly and thoroughly dried.

SINGH (B. N.) & MATHUR (P. B.). **Negative correlation between the occurrence of polyphenol oxidase and diastase and the degree of incidence of 'blackheart' of Potato.**—*Phytopathology*, xxvii, 10, pp. 992–1000, 1937.

A negative correlation was detected in the writers' studies at the Benares (India) Institute of Agricultural Research between the enzymic activity of potato tubers and the incidence of 'black heart' [*R.A.M.*, xi, pp. 126, 357], decreasing percentage contents of polyphenol oxidase and diastatic activities being associated with increasing degrees of disease incidence. At a temperature of 21° C. only 0·2 per cent. of the tubers showed symptoms of the disease but the percentage increased with an increase in the storage temperature, reaching 19·4 per cent. at 56°. The disorder would appear to be due to the partial destruction of the enzymes caused by the heating of the potatoes during summer storage, when the respiration of the tubers raises the temperature in the basket by some 5° C. above that prevailing in the storage room. At the same time carbon dioxide accumulates and a corresponding depletion of oxygen takes place in the surrounding air.

TULLIS (E. C.). **Cercospora oryzae on Rice in the United States.**—*Phytopathology*, xxvii, 10, pp. 1005–1008, 1 fig., 1937.

Of recent years *Cercospora oryzae* has been observed in great profusion on rice sheaths, leaves, peduncles, and glumes in Arkansas, Alabama, Louisiana [*R.A.M.*, xvi, p. 708], and Texas, causing a reduction in the effective foliar area of the plants but no other appreciable damage. The fungus produces narrower and lighter brown lesions than those due to *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] or *Piricularia oryzae*. Among the 58 varieties and hybrids resistant to *C. oryzae* in two year's tests were Nira, Tokalon, and C.I. Nos. 461, 2711, 2738, 4603, and 4966; possibly they may be further developed to replace the commercially grown Blue Rose, Edith, Lady Wright, and Early Prolific, which are very susceptible. The pathogenicity of the fungus was established by inoculations on several varieties and hybrid selections

and its subsequent recovery from the lesions thus induced. *C. oryzae* appears to enter the leaves through the stomata and settle in the substomatal epidermal cells. The conidiophores are produced from substomatal hyphal branches. The mycelium is mostly intracellular.

VOLLEMA (J. S.). **Wortelschimmels bij Rubber en Thee.** [Root fungi of Rubber and Tea.]—*Bergcultures*, xi, 43, pp. 1518–1530, 6 figs., 1937.

An account is given of the occurrence of the red root fungus (*Ganoderma pseudoferreum*) [*R.A.M.*, xvi, p. 798] in Javanese *Hevea* rubber and tea plantations, and of promising experiments in the application to tea of Bobilioff's method of combating the disease in rubber by exposure of the roots [ibid., viii, p. 523]. Notes are also given on *Fomes lignosus* in rubber plantations [ibid., xvi, 798] and on *Rosellinia arcuata* [ibid., xvi, p. 635] and *Armillaria fuscipes* [see above, p. 162] in tea gardens, and their control.

BERTRAND (H. W. R.) & MINOR (E. C. K.). **A method of controlling Fomes and other root diseases in replanted Rubber areas.**—*Trop. Agriculturist*, lxxxix, 3, pp. 135–140, 1937.

The authors state that the three dangerous root diseases of *Hevea* rubber in Ceylon, caused by *Fomes lignosus*, *F. noxius* [*R.A.M.*, xvii, p. 62] and *Poria hypobrunnea* [ibid., viii, p. 267], are far more common in replanted areas than was previously suspected. While fully agreeing with the desirability, stressed by Sharples in his recent book [ibid., xvi, p. 60], of promptly removing all 'knots' of infection from the soil before the roots of young rubber plants have begun to interlace, they consider that the complete removal of all infected material, especially on steep or boulder land, would not be always economically possible or agriculturally advisable. Instead of the present practice of planting thick stands, to allow for losses from root diseases, they suggest the use of a mixture of indicator plants, namely, *Crotalaria anagyroides*, *Tephrosia vogelii*, and *Boga medeloa*, which should be sown together after the removal of grass and all climbing covers from the soil. *C. anagyroides* is very susceptible to attack by *Sclerotium rolfsii* and pink disease [*Corticium salmonicolor*], and *T. vogelii* and *B. medeloa* by *Irpex subvinosus*, but if the seed of the three species is well mixed before sowing, the danger of these parasites killing large patches of the plants will be minimized. The necessity is emphasized of training the plantation staffs to recognize and treat the 'top' diseases of the 'indicator' bushes, which during the first two years from sowing may be profitably controlled by burning affected parts of diseased bushes and spraying the stems of the neighbouring plants with Bordeaux or Burgundy mixture. Prompt spotting of all the indicator bushes attacked by the root diseases is essential; the site in the field of such bushes is marked by a small red flag, and later all infected material is carefully removed and immediately burnt in a portable incinerator. In a number of cases attacked rubber 'buds' are stated to have been saved by wiping off the mycelium and applying 2 per cent. copper sulphate; this method is, however, only effective if the bark is not already killed.

BEARD (F. H.). **Observations on the incidence of downy mildew on new seedling varieties of Hops at East Malling, 1924–36.**—*J. Pomol.*, xv, 3, pp. 205–225, 1 graph, 1937.

In this paper the author gives a summarized account of the observations made from 1924 to 1936, inclusive, on the incidence of the hop downy mildew (*Pseudoperonospora humuli*) [*R.A.M.*, xvi, p. 835] on a wide range of new hybrid seedling varieties of hops and on strains of Fuggle, grown at the East Malling Research Station. The results show that while the intensity and the form of the disease (mainly spike production and cone infection) were largely influenced by the spring and summer rainfall, the relative susceptibility of the various seedlings remained fairly constant. Records of the incidence of the disease on seedlings of various parentages showed that seedlings of certain crosses have on the whole a high percentage of hills bearing spikes, whereas certain hybrid seedlings obtained with *Humulus americanus* and its variety *neo-mexicanus* as female parents, proved to be very susceptible to attack on the cones. Practically all the seedlings which showed severe rootstock infection were derived from the same American variety (Oregon Cluster), indicating a very close correlation between parentage and susceptibility to the disease. Only two of these seedlings, viz., Quality Hop 0063 and Fill-pocket (Z 62), have so far shown any marked resistance, and are included in a list of six new seedlings of various parentages which may be recommended for commercial cultivation. Of these additional four, Early Promise [loc. cit.] is stated to be definitely resistant to cone infection, and the New Mexican hybrid, Cats-Tail (OZ 79), has shown itself less susceptible to attack than another heavy cropping variety of the same parentage. At East Malling Fuggle was highly resistant, but there was evidence that various strains of this variety are in cultivation.

It is finally stated that routine spraying with Bordeaux mixture was largely effective in preventing attacks of the downy mildew on the cones.

JENKINS (ANNA E.). **New species of Sphaceloma on Aralia and Mentha.**—*J. Wash. Acad. Sci.*, xxvii, 10, pp. 412–414, 1 pl., 1937.

English and Latin diagnoses are given of two of the new species of *Sphaceloma*, namely, *S. araliae*, causing stem and leaf scab of *Aralia spinosa* in Maryland, and *S. menthae*, responsible for the so-called 'leopard spot disease' of the foliage, stems, and rootstocks of cultivated peppermint (*Mentha piperata*) in Indiana. The latter fungus is characterized by erumpent, superficial, hemispherical or flattened acervuli, 15 to 80 μ or more in diameter, a compact palisade of pale yellow conidiophores, 10 to 25 μ in thickness, and spherical to elliptical, hyaline conidia, 3 to 8 by 2·5 to 4 μ. The aspect of the thallus on potato dextrose agar is suggestive of *Myriangium*, the colour gradually turning from Varley's brown surrounded by Hay's maroon to pallid or light brownish-drab, while a pale yellowish-olive tint is imparted to the medium. The lesions produced by *S. menthae* are raisin-black, the central part becoming pallid to pale vinaceous-drab, circular to irregular or elliptical, up to 3 to 5 mm. in diameter.

Rands (R. D.) & Abbott (E. V.). **Root rot disease of C.P. 28/19.**—*Sug. Bull., New Orleans*, xv, 19, pp. 3–6, 1937. [Abs in *Facts ab. Sug.*, xxxii, 12, p. 483, 1937.]

The very unsatisfactory condition of autumn-planted C[anal] P[oint] 28/19 sugar-cane on heavy Louisiana soils in the spring of 1937, expressed by wilting, stunting, and deterioration of stand, was diagnosed as primarily due to *Pythium* root rot [chiefly *P. arrhenomanes: R.A.M.*, xvi, p. 206], favoured by abnormally high early winter temperatures followed by alternate wet and dry periods. On the other hand, the summer (August) plantings of the same variety were in excellent form, a fact pointing to the advisability of earlier planting on the heavier types of soil under local conditions.

Zundel (G. L.). **Miscellaneous notes on the Ustilaginales.**—*Mycologia*, xxix, 5, pp. 583–591, 1 pl., 1937.

Among the fungi discussed in these notes are the following: *Ustilago hitchcockiana* n.sp., collected on *Cynodon dactylon* in Kenya, forms linear sori, 2 to 7 cm. long, entirely destroying and deforming the inflorescence, with globose to subglobose, smooth spores, light olivaceous (dark brown in the mass) and 3·5 to 5·5 (rarely 7) μ in diameter. *Sphacelotheca kenyae* n.sp. is described on a species of *Hyparrhenia* from Kenya, *Sorosporium ischaemoides* (P. Henn.) n.comb. on a species of *Andropogon* from the Congo is the new name for *Ustilago ischaemoides*, *S. panici* var. *kinshasaensis* on *Panicum kinshasaënse* from the Congo is raised to specific rank as *S. kinshasaensis* (Beeli) nom. nov. and a redescription of *S. wildemanianum* is given from correctly named material on *Andropogon gayanus*. Latin diagnoses are given of the new species.

Poeverlein (H.). **Die Verbreitung der süddeutschen Uredineen.** [The distribution of the south German Uredineae.]—*Ber. bayer. bot. Ges.*, xxii, pp. 86–120, 1937.

Following some observations on certain idiosyncrasies in host-parasite interrelationships, as reflected in the erratic distribution of the south German Uredineae, the writer furnishes two extensive lists, one comprising those rusts which have hitherto only been detected sporadically in the regions visited notwithstanding the prevalence of their hosts, and the other enumerating members of the same group absent from south Germany although their hosts are present.

Dominik (T.). **Grzyby pasorzytnicze zebrane w okolicy Włocławka w sierpniu 1934 roku.** [Parasitic fungi collected in the neighbourhood of Włocławek in August, 1934.]—*Acta Soc. Bot. Polon.*, xii, 2, pp. 201–205, 1935. [French summary. Received 1937.]

This is a very briefly annotated list of 60 species of parasitic fungi, arranged in their systematic order, which were collected in 1934 on plants of economic or ornamental value in the neighbourhood of Włocławek, near Warsaw.

Gadd (C. H.). **A leaf-fall disease of Grevilleas.**—*Tea Quart.*, x, pp. 156–159, 1937.

An account is given of a leaf-fall disease of *Grevillea* [*robusta*] trees in Ceylon prevalent mainly in districts below 1,000 ft. and occurring up to 1,600 ft. It is characterized by premature defoliation chiefly of the young leaves, but older ones may be shed also. Freshly fallen leaves appear healthy except for one or more spots irregular in size and shape, the young leaves being shrivelled, curled, and often blackened at the edges; generally speaking the dead areas were remarkably small. A species of *Phyllosticta* was consistently found to be present on diseased specimens from various estates and was regularly isolated from such material. Inoculation experiments on *Grevillea* leaves in the laboratory showed that the fungus was capable of producing infection, and indicate that it may be responsible for the disease. The fact that cultures of the *Phyllosticta* do not fruit at room temperature (20° C.) but produce abundant spores at 32° C. may explain the restriction of the disease to the lowest elevations.

Koenig (P.). **Über Tabakkrankheiten und -schädlinge.** [On Tobacco diseases and pests.]—*Angew. Bot.*, xix, 5, pp. 530–541, 1937.

In this paper (read at a meeting of the Association of Applied Botany at Darmstadt) a concise account is given of the history of tobacco wildfire (*Pseudomonas tabaci*) [*Bacterium tabaci*] and of the investigations proceeding on its control in Germany, especially by the development of resistant varieties. In connexion with some general observations on the virus diseases of tobacco, mention is made of the spasmodic character of the outbreaks of such disorders. During the period from 1927–34, for instance, tobacco mosaic only occurred sporadically in Germany, but in the last year or two it has again become much more widespread. Similarly, the 'mauke' [scab] disease [*R.A.M.*, xv, p. 119], which had more or less died out of recent years, has lately revived with considerable intensity. Some remarks are made on phosphorus and boron deficiency [ibid., xvi, p. 781]; the essential character of both these elements in tobacco nutrition has been convincingly demonstrated by experiments at the Tobacco Research Institute. Boron may fitly be termed a 'mineral vitamin' exerting an influence on plants comparable to that of iodine on the human constitution. It is regularly applied (in the form of borax) to the tobacco crop at the rate of 20 kg. per hect.

Johnson (J.). **Relation of water-soaked tissues to infection by Bacterium angulatum and Bact. tabacum and other organisms.**—*J. agric. Res.*, lv, 8, pp. 599–618, 14 figs., 1937.

A full account is given of the author's studies on the relationship of water-soaking of plant tissues, induced by the application of high water pressure to the roots, to infection with *Bacterium angulatum* and *Bact. tabacum*, and with certain other saprophytic and parasitic organisms, a reference to which has already been noticed from another source [*R.A.M.*, xvi, p. 68]. The results showed that the condition studied, if of sufficient duration, may render a plant, normally completely immune from attack by a given micro-organism, highly susceptible, as exemplified by the fact that extensive necrosis was secured by spraying

suspensions of *Bact. angulatum* and *Bact. tabacum* on water-soaked plants of such species as tomato, lucerne, bean (*Phaseolus vulgaris*), hemp, rose, apple, locust (*Robinia pseud-acacia*), flax, marigold (*Tagetes patula*), and poinsettia (*Euphorbia pulcherrima*), which normally are not attacked by these organisms. Other plant species, however, remained immune even in the water-soaked condition. Inoculation of water-soaked tomato plants with *Bact. phaseoli* [ibid., xvi, p. 590], which normally is not capable of affecting this host, caused necrosis, and a small amount of necrotic action was also secured on water-soaked tomato sprayed with such saprophytic species as *Bacillus* [*Bact.*] *coli*. There was no evidence of mechanical injury to the tissues by water-soaking, and this indicates that *Bact. angulatum* and *Bact. tabacum* enter the tobacco plant through the stomata, and not necessarily through cuticular or epidermal wounds, as was previously supposed.

Generally speaking, the results of this work, taken in conjunction with those obtained by Clayton's external method of water-soaking [ibid., xv, p. 537], may have a wide application in furthering the present understanding of infection and progress of disease in plants. They may also have a practical bearing on the present views in regard to the over-wintering of certain plant parasites in species that are normally immune from them, and may thus modify the theories underlying the prophylactic and eradicative control measures now in use.

STANLEY (W. M.). **Chemical studies on the virus of Tobacco mosaic. X. The activity and yield of virus protein from plants diseased for different periods of time.**—*J. biol. Chem.*, cxxi, 1, pp. 205–217, 1937.

Continuing his chemical studies on the tobacco mosaic virus [*R.A.M.*, xvi, p. 499], the writer determined the increase of its protein in Turkish tobacco by means of isolations from plants diseased for varying periods up to 13 weeks. The efficiency of the isolation technique was determined by isolating virus protein from artificially prepared mixtures containing known amounts of the substance. It was found that some 40 per cent. of the virus protein can be isolated from plants containing only about 1 part of this substance per 100,000 of plant material. Virus protein in Turkish tobacco plants was found to increase from an estimated 10^{-6} to 3 mg. per gm. of plant material in the course of five weeks. Virus protein in inoculated leaves was reckoned to increase over a million times during a four-day period, judging by the average number of lesions per leaf of Early Golden Cluster bean (*Phaseolus vulgaris*) developing as a result of infection at stated intervals. Although the virus protein content was found to reach a maximum five weeks after inoculation, the rate of increase reached a climax during the first three. The total nitrogen content of diseased plant extracts remained approximately uniform throughout an eight-week period, whereas the protein nitrogen increased to a maximum and then declined. The amount of low molecular weight protein decreased parallel with the rise in virus protein. No significant difference was detected in the virus activity of protein obtained from plants infected for periods of 2 to 13 weeks, whereas those infected for one week only yielded protein of appreciably slighter virulence.

Wyckoff (R. W. G.). **Molecular sedimentation constants of Tobacco mosaic virus proteins extracted from plants at intervals after inoculation.**—*J. biol. Chem.*, cxxi, 1, pp. 219–224, 1 pl., 1937.

Analytical ultracentrifugal studies, using an improved model of the air-driven machine recently described [*R.A.M.*, xvi, p. 712], were made of the sedimentation rates of virus proteins isolated from a series of Turkish tobacco plants harvested at varying periods up to 13 weeks after inoculation with the ordinary tobacco mosaic virus [see preceding abstract]. The protein samples were prepared by two methods, half by quantity ultracentrifugation and half by a chemical technique entailing ammonium sulphate precipitations, the solvent in both cases being 0·1 M phosphate buffer of $P_H 7$. The virus proteins extracted from plants within four weeks of inoculation and purified by quantity ultracentrifugation consist of a single molecular species with $^s20^0 = 174 \times 10^{-13}$ cm. sec. $^{-1}$ dynes $^{-1}$. A second molecular component with $^s20^0 = 200 \times 10^{-13}$ exists in the two- and three-week samples made with ammonium sulphate and develops after a few days in the corresponding ultracentrifuged proteins; it is present in the proteins from plants that have carried the disease for more than four weeks. The very young one-week protein differs from those longer in the plant in its failure to produce the heavy molecular component even in response to ammonium sulphate treatment.

Tobacco mosaic virus proteins isolated by ultracentrifugation from plants 2 and 13 weeks after inoculation are single-boundaried if distilled water is used instead of phosphate buffer as a solvent. The virus protein in the plants themselves thus consists of only one molecular species, changing with the lapse of time after inoculation and becoming increasingly accessible to the influence of salts. Proteins isolated and purified by differential ultracentrifugation or two cautious crystallizations with ammonium sulphate show a high degree of molecular homogeneity; when water is used instead of phosphate as a solvent, the ultracentrifuged proteins are unusually homogeneous. The sharply sedimenting boundaries of such proteins contrast with the diffuse boundaries and greater mean sedimentation constants given by samples subjected to more rigorous chemical treatment.

Loring (H. S.) & Wyckoff (R. W. G.). **The ultracentrifugal isolation of latent mosaic virus protein.**—*J. biol. Chem.*, cxxi, 1, pp. 225–230, 1 pl., 1937.

The application of the quantity and analytical ultracentrifuges [see preceding abstract] to the purification and characterization of the virus protein associated with latent mosaic of potato (ring spot strain) [*R.A.M.*, xvi, p. 702] in Turkish tobacco and *Nicotiana glutinosa* plants is described. The results of chemical analyses of the supernatant liquids following ultracentrifugation and ultracentrifugal analyses of purified preparations show that a homogeneous high molecular weight protein is obtained after three ultracentrifugations. Preparations made by the method therein outlined show a principal boundary with $^s20^0 = 113 \times 10^{-13}$ cm. sec. $^{-1}$ dynes $^{-1}$ and usually a second faint boundary with $^s20^0 = 131 \times 10^{-13}$. The protein is present to the extent of about 0·02 to 0·1 mg. per c.c. of the juice of infected plants, reaching a somewhat

higher concentration in *N. glutinosa* than in tobacco. The latent mosaic virus protein was found to be between 1,000 and 10,000 times more infectious than the original juice.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, ix, 7, pp. 146–147, 153–156, 1937.

Germany. An Order of 6th September, 1937, in pursuance of the policy of gradual elimination of potato varieties resistant to wart [*Synchytrium endobioticum*] [cf. *R.A.M.*, xiv, pp. 400, 736, and above, p. 197] enacts that as from 1938 only such quantities of selected material of the following (to be determined in each case by the administration of the Reich Farmers' Leader) as are required for export will be admitted to cultivation: Allerfrüheste Gelbe, Frühe Rosen, Zwickauer frühe Gelbe, Centifolia, Industrie, and Prof. Wohltmann. In 1938 only 600 hect. may be planted with Erstling [Duke of York] and in 1939 (for the last time) 400.

Memorandum on the legislative position in regard to plant imports into Kenya as at 31st October, 1937.—3 pp., 1937. [Mimeographed.]

By an Order (Government Notice No. 668 of 1937) dated 2nd September, 1937, made under the Plant Protection Ordinance, 1937 [*R.A.M.*, x, p. 208], the following provisions are made for the regulation of plant imports. Permits for the importation of seeds (as opposed to other plant parts) are not ordinarily required, but exceptions to this rule are constituted by coffee (other than roasted beans), cotton, tobacco, tea, cacao, coco-nuts, groundnuts, lucerne and clover, rubber, maize, wheat, clover, and peach. The importation of all kinds of fruit trees or fruit grown in or consigned from Japan, China, Korea, or Manchuria [Manchukuo] is prohibited. No plants or parts of any plant of the order Gramineae (except seeds) intended for use as fodder may be imported into the Colony. The usual arrangements for the official inspection, disinfection, and (if necessary) destruction of suspected plant imports are operative.

Government Notice No. 356 of 1937 prohibits the importation of any rooting medium for plants consisting wholly or in part of soil, whether or not it is attached to a plant.

Black stem rust quarantine. Quarantine No. 38.—4 pp., U.S. Dep. Agric. B.E.P.Q., 1937.

Under the terms of an amendment to quarantine No. 38, relating to black stem rust of cereals (*Puccinia graminis*) effective as from 1st September, 1937, Missouri, Pennsylvania, Virginia, and West Virginia are added to the list of protected States, into and between which only the Japanese barberry (*Berberis thunbergii*) and its rust-immune varieties [*R.A.M.*, xvii, p. 102] may be moved without special permit [ibid., xiv, p. 672].

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xi, 10, p. 224, 1937.

French West Africa (Sudan). A Decree of the Governor-General of 7th July, 1937, enforces the declaration of 'rosette' disease of groundnuts [cf. *R.A.M.*, xvi, p. 784].

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MARTIN (L. F.), MCKINNEY (H. H.), & BOYLE (L. W.). **Purification of Tobacco mosaic virus and production of mesomorphic fibres by treatment with trypsin.**—*Science*, N.S., lxxxvi, 2234, pp. 380–381, 1937.

In a typical tobacco mosaic virus purification experiment, the impure virus protein in approximately 1 per cent. solution was incubated for 3 to 5 hours with 3·3 mg. per c.c. of Fairchild's trypsin. The protein precipitable by trichloracetic acid decreased in a few minutes from 11·4 to 8·3 mg. per c.c., and in a few hours the solution assumed an opaque appearance. Apparently pure virus protein had separated at P_H 7·5 in the form of mesomorphic fibres [*R.A.M.*, xvi, pp. 639, 778], which temporarily disintegrated on shaking the solution but re-formed after standing for an hour or two. Acidifying the solution to P_H 5 precipitated fine crystals of the typical needle form of the protein. Assays were made of the virus protein purified by incubation with trypsin and subsequently crystallized, in comparison with crystals obtained in the usual way as controls. All samples were brought to an equivalent protein content, 5·8 mg. per c.c. in 0·1 M phosphate buffer at P_H 7, and used at appropriate dilutions to inoculate the first leaves of eight-day-old Scotia bean (*Phaseolus vulgaris*) plants. The results of the tests indicated that the infectivity of the trypsin-purified protein is equal or superior to that of the controls.

JOHNSON (J.) & HOGGAN (ISMÉ A.). **The inactivation of the ordinary Tobacco mosaic virus by micro-organisms.**—*Phytopathology*, xxvii, 10, pp. 1014–1027, 1 fig., 1937.

The inactivating effect of a number of bacteria and fungi in pure culture on the ordinary tobacco mosaic virus (tobacco virus 1), both in leaf tissue and plant extract, was investigated and found to be much more potent in the latter than in the former group of organisms, especially in destroying the virus in the host tissue. This result is attributed to the low cellulose-decomposing capacity of the bacteria, which prevents them from attaining contact with the virus particles in the cells, which are readily reached, on the other hand, by the fungi with their active cellulose-destroying faculties. Even in extracts permitting direct contact with the virus particles some of the bacteria, e.g., *Bacillus* [*Bacterium*] *radiobacter* [*R.A.M.*, xi, p. 357] and *Phytomonas* [*Bact.*] *tumefaciens*, are comparatively poor inactivators, though others, such as *Aerobacter aerogenes* [ibid., v, p. 439; xiv, p. 403], rapidly

inactivate the virus in these circumstances. Of the 25 fungi used in the tests, *Sclerotinia fructigena* and *Venturia inaequalis* were particularly efficient inactivators but all were capable of destroying the active principle of the virus given a sufficient length of time—sometimes exceeding four months at room temperature.

In some cases it was possible greatly to expedite the rate of both bacterial and fungal inactivation of the virus by aeration of the cultures by the continuous mechanical rocking of two-arm culture tubes. The same process, applied to sterile virus extract for periods up to 28 days, not only failed to cause inactivation but resulted in a fairly marked increase in the number of local lesions on hybrid tobacco (*Nicotiana tabacum* × *N. glutinosa*) leaves as compared with non-aerated extracts. The complete exclusion of oxygen from virus-infected moist soil largely or entirely inhibits the inactivation of the virus therein owing to the reduced activity of the aerobic soil organisms.

Bacteria and fungi in pure culture occasionally attenuate only a small percentage of tobacco virus 1, but over 98 per cent. of the local lesions tested from cultures in which the virus was almost completely inactivated yielded normal virus on re-inoculation into tobacco.

BALD (J. G.). **The use of numbers of infections for comparing the concentration of plant virus suspensions. 4. Modification of the simple dilution equation.**—*Aust. J. exp. Biol. med. Sci.*, xv, 3, pp. 211–220, 1937.

Infection dilution data published by Stanley [*R.A.M.*, xvi, pp. 499, 567], using crystalline protein of ordinary tobacco mosaic and aucuba mosaic, agree well in part with the equation $y/N=1-e^{-pn_1x}$ recently propounded by the author [ibid., xvi, pp. 495, 498], but some of the figures are widely divergent and if the protein is pure virus some doubt is thrown on the suggestion previously made that distortion of the dilution series is mainly due to the presence of impurities. The most likely explanation of the fall in infective power with increasing concentrations of virus now appears to be that it is due to an aggregation of virus particles.

An equation showing the relation between the concentration of free virus particles and aggregates and the concentration of single virus particles is therefore developed by the author, on the assumption that virus particles in solution aggregate by joining end to end in chains, and on this basis the probability of infection is given by $y/N=1-e^{-qn_x}$ where q is the probability of one or more particles per unit volume of inoculum entering the tissues. The equation is fitted to dilution experiments with purified samples of the streak, ordinary tobacco, and aucuba mosaic viruses and agreement within the limits of experimental error obtained in most cases with virus samples buffered near the neutral point and even with unbuffered samples.

MANIL (P.) & GRATIA (A.). **Transmission du virus de la mosaïque ordinaire du Tabac à l'Orobanche, plante parasite dépourvue de chlorophylle.** [The transmission of the ordinary Tobacco mosaic virus to *Orobanche*, a parasitic plant devoid of chlorophyll.]—*C.R. Soc. Biol., Paris*, cxxvi, 24, pp. 67–69, 1937.

The juice of an *Orobanche* (probably *O. minor*) stem inoculated in

infinitesimal quantity into *Nicotiana glutinosa* induced the typical local lesions of tobacco mosaic. The *Orobanche*, which was parasitizing a mosaic tobacco plant in a greenhouse at the Gembloux (Belgium) Agricultural Institute, showed no outward signs of disease. The virus concentration in the juice extracted from the stem of *O. minor* and that of its host was experimentally shown by local lesions on *N. glutinosa* and by serological tests to be of the same order of magnitude. This is believed to be the first record of a virus disease among the Orobanchaceae.

REID (J. J.), HALEY (D. E.), MCKINSTRY (D. W.), & SURMATIS (J. D.). **The relation of catalase activity to the microflora of cured and fermenting Tobacco.**—Abs. in *J. Bact.*, xxxiv, 4, p. 460, 1937.

An extensive microflora was detected on the leaves of cured Pennsylvania cigar-leaf tobacco, largely consisting of bacteria and species of *Aspergillus*, *Penicillium*, and *Rhizopus*. Poor-grade tobacco showed fewer bacteria than that of superior quality, but was apt to bear a larger number of fungi. Catalase activity of the cured product was found to be directly related to high bacterial counts.

ALLAN (J. B.), HILL (A. V.), & ANGELL (H. R.). **Downy mildew (blue mould) of Tobacco: its control by benzol and other vapours in covered seed-beds. III.**—*J. Coun. sci. industr. Res. Aust.*, x, 4, pp. 295–308, 2 figs., 1937.

Comparative experiments were made during 1936 and 1937 at Eurobin (Victoria), Swan Hill (Victoria), and Canberra, to ascertain the efficacy in the control of downy mildew of tobacco (*Peronospora tabacina*) [*R.A.M.*, xvii, p. 77] of the vapours of benzol, toluol, X3 solvent, X300 special boiling-point spirit, C.O.R. benzol mixture, 'Plume' cracked motor spirit, H 74, iodine, and quinone applied to the seed-beds under different climatic conditions. It was found that only benzol gave complete protection from the disease and that only toluol and X3 were likely to be useful as substitutes.

The optimum concentration of benzol vapour varied with the temperature and proximity to sources of infection. The concentration provided by evaporation from a surface 1/72 of the seed-bed area always prevented the disease, but an evaporation surface of 1/100 may be used successfully provided that the sources of infection are distant.

Studies on the relative efficacy of hydrocarbons, including petroleum fractions, showed that the degree of control effected by them depends on their content of aromatics of low boiling-point. It was found that toluol and X3 solvent act identically in distillation and evaporation. Distillation ranges and comparative rates of evaporation demonstrated clearly that aromatics higher in the series than toluene should not be used. Under the conditions of the experiments the most effective control was obtained by using benzol vapour in seed-beds uncovered for 11 hours on fine days and in others uncovered for 9 hours each day irrespective of weather conditions. The authors avoided, in the course of their experiments, the damping-off and other troubles of seedlings grown in covered beds by weekly treatment with Cheshunt mixture. For

the dressing of the calico seed-bed covers they recommend shirlan AG, which prevents fungal discoloration and other signs of deterioration.

McLean (Ruth), Wolf (F. A.), Darkis (F. R.), & Gross (P. M.). **Control of downy mildew of Tobacco by vapours of benzol and of other organic substances.**—*Phytopathology*, xxvii, 10, pp. 982–991, 3 figs., 1937.

The results of experiments in North Carolina confirmed those obtained in Australia in regard to the efficacy of benzol vapour in the control of tobacco downy mildew (*Peronospora tabacina*) [see preceding abstract], and further demonstrated a similar fungicidal action in the case of monochlorbenzene. The admixture with benzol vapour at high concentrations of lubricating oil in the ratio of 1:5 by volume retards the evaporation of benzol and so prevents the toxic effect liable to be exerted by the latter on tobacco seedlings without impairing the efficacy of the treatment. It is important to employ properly constructed beds for the vapour treatments, during which the beds should be covered with a cotton fabric of the texture of sheeting. The evaporators should have a surface approximating to 1/72 of that of the seed-bed and be provided with sufficient clearance to allow of free evaporation.

Hopkins (J. C.). **Seasonal notes on Tobacco diseases. 10. Precautionary methods in seed-beds.**—*Rhod. agric. J.*, xxxiv, 10, pp. 770–772, 1937.

Precautionary measures recommended in the preparation of tobacco seed-beds in Rhodesia for the prevention of seedling diseases such as frog eye [*Cercospora nicotianae*: *R.A.M.*, xvi, p. 780] are: changing the site of the seed-bed, destruction of refuse from previous seasons, use of healthy seed, thin sowing, sterilization of the seed-bed covers with formalin or hot water, and frequent regular spraying of the seedlings with Bordeaux mixture (4–4–50).

Park (M.). **A note on the occurrence of blossom-end rot of Tomatoes at Anuradhapura, 1937.**—*Trop. Agriculturist*, lxxxix, 3, pp. 141–147, 1 graph, 1937.

Experimental applications of artificial fertilizers in 1936–7 at Anuradhapura failed to affect the incidence of blossom-end rot of tomatoes [*R.A.M.*, xvi, p. 502], a disease which is stated to be common in Ceylon, frequently causing considerable losses. A direct relationship was observed, however, between fluctuations in the amount of precipitation within a given interval and the development of the disease; thus, while the average percentage of diseased fruits in the total number gathered was about 20, the picking on 9th January, 1937, following seven days' exceptionally heavy rainfall, contained as much as 41·8 per cent. fruits affected with blossom-end rot. The collection of further data on the problem is considered desirable.

Bertus (L. S.). **Blossom-end rot of Tomato fruits.**—*Trop. Agriculturist*, lxxxix, 4, pp. 220–221, 1 pl., 1937.

This is a brief, semi-popular account of blossom-end rot of tomato fruit [see preceding abstract] in Ceylon. Control recommendations

include regular watering, efficient drainage, aeration, and mulching of the soil, light shading, and the avoidance of fresh cattle manure and large quantities of fertilizers.

ORTH (H.). **Die Bakterienwelke der Tomaten.** [Bacterial wilt of Tomatoes.]—*Kranke Pflanze*, xiv, 10, pp. 161–163, 1937.

This is an abridged version of the writer's studies on bacterial wilt of tomatoes *Bacterium* [*Aplanobacter*] *michiganense* in Germany, a fuller account of which from another source has already been noticed [*R.A.M.*, xvii, p. 80]. It is stated in a footnote to this paper that kortofin (Chem. Fabrik Marktredwitz, Bayr. Ostmark) may be used as a substitute for 0·1 per cent. mercuric chloride for the disinfection of knives or fingers during the removal of young shoots.

HENDRICKX (F. L.). **Sur l'antagonisme existant entre une bactérie et l'agent [Ophiostoma ulmi (Schwarz) Nannfeldt] de la maladie de l'Orme (Ulmus sp.).** [On the antagonism existing between a bacterium and the agent [*Ophiostoma ulmi* (Schwarz) Nannfeldt] of the Elm (*Ulmus* sp.) disease.]—*C.R. Soc. Biol., Paris*, cxxvi, 24, pp. 99–100, 1937.

Among the organisms isolated from an elm branch affected by parasitic tylosis in Belgium, besides the agent of the disease (*Ophiostoma* or *Ceratostomella ulmi*) [*R.A.M.*, xvii, p. 142], was a bacterium which exercised an inhibitory action on the development of the fungus both *in situ* and in malt agar cultures (P_H 6·5). A culture of the organism [which is briefly described] on a strongly buffered synthetic medium, sterilized for half an hour at 112° C., exerted no marked inhibitory action on the elm pathogen but stimulated its sporulation.

CAMPBELL (W. A.). **The cultural characteristics of Fomes connatus.**—*Mycologia*, xxix, 5, pp. 567–571, 2 figs., 1937.

The cultural characteristics of *Fomes connatus* [*R.A.M.*, xv, p. 66] are given based on two isolations of the fungus, one obtained from decayed hard maple bearing fruit bodies and the other from spores from a sporophore on *Acer negundo*. Both *A. saccharum* and *A. rubrum* are stated to be common hosts of the fungus among the northern hardwoods of the United States.

The fungus grows slowly forming a mat, usually cottony, over the inoculum, becoming appressed towards the margin, azonate, occasionally with sectors. The submerged hyphae, 2 to 5μ in diameter, are often much contorted and twisted, without clamp-connexions; the superficial hyphae are similar, thin-walled, non-staining when empty, and fibrous hyphae 2 to 4μ with moderately thick walls occur commonly in old cultures. On gallic acid medium there was a faint to moderately strong brown diffusion zone with no growth in seven days, and on tannic acid medium a faint diffusion zone and no growth. The optimum temperature for growth was about 25° C. and none occurred at 35° C. The best growth of the fungus on agar was secured on potato dextrose and 5 per cent. malt media. On sterilized hard maple blocks the fungus grew vigorously, completely covering them with a dense thick cottony growth. The isolation from *A. negundo* produced in a tube culture a

well-defined poroid area with cystidia and spores characteristic of *F. connatus*.

Pārskats par kaitēklu un slimību izplatību Latvijas valstsmežos 1935/36 g. [A summary of the incidence of tree pests and diseases in the silvicultural properties of Latvia in 1935–36.]—Reprinted from *Latvijas mežu statist.* [*Statist. for.*], ix, 11 pp., 1937. [French summary.]

Lophodermium pinastri [*R.A.M.*, xvi, p. 847] is stated to be the most injurious fungal pathogen of pines in Latvia [ibid., xv, p. 610], where spraying with lime-sulphur is practised for its control, especially in nurseries. The same host was further attacked during the period under review by *Fomes annosus* [ibid., xvii, p. 5] (also occurring on spruce), *Peridermium pini* [ibid., xvii, p. 87], *Melampsora pinitorqua* [ibid., xv, p. 618], and *Trametes* [*F.*] *pini* [ibid., xvi, p. 848], while *F. igniarius* [ibid., xvi, p. 715] is prevalent on aspens.

Grimm (W.). **Beitrag zur Lösung des Lärchenrätsels.** [A contribution to the solution of the Larch problem.]—*Forstwiss. Zbl.*, lix, 16, pp. 501–512; 17, pp. 540–549, 1937.

Disturbances in transpiration associated with adverse environmental factors are suspected by the writer to be the primary cause of the baffling dying-off of larches of recent years in Germany [*R.A.M.*, xvi, p. 508]. The trees thus weakened are readily accessible to infection by the canker-producing fungus [*Dasyscypha willkommii*]. After the age of 30 to 40 years the larch roots reach a soil depth at which the balance of humidity and moisture relations becomes more stabilized, and from this stage onwards recovery frequently ensues. Discussing his investigations in relation to silvicultural practice, the writer emphasizes the superiority of the Sudetic over the Alpine larch from the standpoint of disease resistance, and the advisability of using the former for extended cultivation in regions to which the tree is not indigenous.

Kisser (J.) & Lohwag (K.). **Histochemische Untersuchungen an verholzten Zellwänden.** [Histochemical studies on lignified cell walls.] —*Mikrochemie*, xxiii, 1, pp. 51–60, 2 figs., 1937.

The intensive histochemical examination at the Biological Institute of the Vienna Academy of Sciences of silver fir (*Abies alba*) wood showed that the tangential walls of recently formed cells swell much more readily than the radial walls or those of older material. This explains the characteristic disintegration produced in the wood by *Fomes hartigii* [*R.A.M.*, xvii, p. 86], which spreads principally in the old cells and dissolves the tangential walls.

Jaag (O.). **Sur une nouvelle maladie du Sapin blanc et de l'Épicea.** [On a new disease of the Silver Fir and of the Spruce.]—*J. for. suisse*, lxxxviii, 9–10, pp. 201–203, 2 pl., 1937.

This is a summary, translated from the German by J. P. C., of O. Jaag's account of the new silver fir and spruce disease in Switzerland caused by *Pleurotus mitis*, a review of which from another source has already appeared [*R.A.M.*, xvi, p. 717].

The properties of British Honduras Pitch Pine (Slash Pine).—Pinus caribaea Mor.—*For. Prod. Res. Rec., Lond.*, 20, 9 pp., 2 pl., 1 map, 1937.

The results of experiments at the Forest Products Research Laboratory at Princes Risborough showed that the heartwood of the British Honduras pitch pine (*Pinus caribaea*) is moderately resistant to the attacks of *Merulius lacrymans*, *Coniophora cerebella* [*C. puteana*], *Poria vaporaria*, *Lenzites saepiaria*, and *L. trabae*; it was, however, slightly more susceptible to rotting by *Lentinus lepideus*, which was observed in the heartwood of one of the logs received at the laboratory from British Honduras. It is considered, therefore, that although *P. caribaea* timber should usually prove fairly durable under conditions favourable to decay, it would be unwise to use it untreated for telegraph poles, railway sleepers, or constructional work in exposed situations.

Kemper (W.). **Zur Morphologie und Zytologie der Gattung Coniophora, insbesondere des sogenannten Kellerschwamms.** [On the morphology and cytology of the genus *Coniophora*, especially of the so-called cellar fungus.]—*Zbl. Bakt.*, Abt. 2, xcvii, 4–8, pp. 100–124, 20 figs., 1937.

The writer fully describes his cytological examination of the so-called cellar fungus (*Coniophora cerebella* [*C. puteana*]) and *C. arida*, a closely related species differing from the former chiefly in its brownish-yellow to dark brown fruit bodies with a white to yellow border growing out into a delicate white mycelium under humid conditions. The fructifications of *C. puteana* are at first livid olive, turning brown to sooty-black. The strain of *C. puteana* chiefly used in the studies was supplied by the Botanical Institute of the Hann.-Münden College of Forestry and rapidly formed fruit bodies on beech and spruce wood. Three strains of *C. arida* were obtained from fructifications collected in the vicinity on dead spruce branches.

The spores on germination give rise to a coenocytic mycelium, the rapidly growing hyphal tips of which soon protrude above the malt agar substratum. Clamp-connexions are formed only on such aerial hyphae. The development of the whorl clamp-connexions characteristic of the genus is preceded by that of single and double anastomoses. An increase of atmospheric humidity tends to suppress the formation of clamp-connexions. Conidia are not formed. Both species are monoecious and in a sense polyploid, and cytological details regarding each are given. The results of experiments to determine the capacity of *C. puteana* and *C. arida* for the destruction of sterilized wood blocks showed that oak is much more resistant than beech to the attacks of these fungi. *C. arida* causes more extensive disintegration of spruce and pine wood than *C. puteana*.

Mörath (E.). **Holzschutz in Deutschland.** [Wood protection in Germany.]—*Umschau*, xli, 37, pp. 849–851, 3 figs., 1937.

Following a brief exposition of the economic aspects of timber preservation in Germany, the writer concisely presents some useful information [much of which has already been noticed in this *Review* from other sources] concerning modern methods of impregnation against

wood-destroying fungi. The possibilities of preservation are largely determined by the anatomical structure of the different woods. Beech, for instance, is completely permeable throughout, whereas in oak the irregular conformation of the annual rings and the partial closure of the heartwood vessels prevent the thorough and uniform penetration of the preservative. For this reason the average life of well-impregnated beech wood, which in the untreated state lasts only 2 to 3 years, is 30 to 50 years, whereas the corresponding figure for the inherently fairly durable oak (average life untreated 13 years) is only 25 years. Recent experiments on leaching-out have shown that the U salts [*R.A.M.*, xvi, p. 503] compare very favourably in this respect (40 per cent. lixiviation under the most rigorous conditions) with pure fluorides, copper sulphate, zinc chloride, and silicofluorides (90 per cent.), though the corresponding figure for mercuric chloride is only 5 per cent.

Crüger. **Hausschwamm-Untersuchungen für die Praxis.** [Advisory investigations on dry rot.]—*Angew. Bot.*, xix, 5, pp. 541–542, 1937.

Among the points of interest emerging from the inspection, during the period from 1928 to 1936, inclusive, at the Königsberg Plant Protection Station, of 742 wood samples suspected of dry rot infection may be mentioned the larger number of fructifications of *Merulius lacrymans* (the preponderating fungus concerned in the damage) during the summer months than at other seasons. In addition to *M. lacrymans*, which was present on 311 of the samples examined, *M. minor* and *M. sclerotiorum* [*R.A.M.*, xiii, p. 341] occurred in isolated instances, while *Coniophora*, *Polyporus*, and *Lenzites* spp. were also prevalent. Wood-destroying fungi are responsible for heavy annual losses in constructional and other commercial timbers in Germany, which could be greatly minimized by the diffusion among builders, contractors, and farmers of appropriate wood preservation propaganda.

Trotter (H.). **Open tank treatment with ascu.**—*Indian For.*, lxiii, 10, pp. 672–675, 3 pl., 1937.

Details are given of a number of experiments to determine the most effective and economical method of applying the ascu method of timber preservation [*R.A.M.*, xvi, p. 359] to chir [*Pinus longifolia*] and sal [*Shorea robusta*] billets. The best results were obtained by slow heating in water (40 minutes rising to 98° C. and 10 minutes boiling at 98°) followed by one hour's immersion in a tank of cold ascu, which gave practically complete penetration with an average absorption of the preservative of 12 to 13 lb. per cu. ft.

Memento [du Service de la] Défense des Végétaux [Maroc] [Memoranda of the Plant Protection Service of Morocco].—37–48, 50, 62 pp., 45 pl., 1937.

No. 37 of this series of semi-popular pamphlets, dealing with the occurrence and control of plant diseases in Morocco, gives an account of blossom-end rot of tomatoes [see above, p. 212], which has been found to be more prevalent on the thin-skinned varieties than on the ribbed type of fruit commonly grown locally, while *Lycopersicum cerasiforme*, *L. piriforme*, and *L. pimpinellifolium* appear to be immune. Tomato

septoriosis (*Septoria lycopersici*) [*R.A.M.*, xvi, p. 655; xvii, p. 15, *et passim*] is stated in pamphlet 38 to cause considerable damage in the maritime regions of the country, especially where the routine treatment of the plants with Bordeaux mixture is omitted.

A more extensive account of artichoke [*Cynara scolymus*] anthracnose (*Ascochyta hortorum*) than that presented in pamphlet 39 of this series has already been noticed from another source [ibid., xv, p. 770]. The same host is stated in pamphlet 40 to be very liable to severe infection by *Ramularia cynarae* [ibid., vii, p. 556], the agent of greyish lesions on the foliage and inflorescences; in addition to appropriate cultural measures, the treatment of the growing crop (up to the time of head formation only) with copper-containing mixtures is recommended.

Tomatoes, potatoes, eggplants, and other Solanaceae are attacked by *Alternaria solani* [ibid., xvii, p. 60], good control of which may be secured, according to pamphlet 41, by applications of Bordeaux mixture, while disinfection of the seed-bed with formalin (2 in 100) a week before sowing considerably reduced the infection of young plants at the collar. The same hosts, besides a number of others, are stated in pamphlet 42 to suffer from rhizoctoniosis (*Rhizoctonia* [*Corticium*] *solani*). The use of mercuric compounds for the control of the disease [ibid., xvi, p. 770] being prohibited by French Moroccan law, the tubers should be disinfected by two to three minutes' immersion in 40 per cent. formaldehyde ($1\frac{1}{2}$ l. in 1 hectol. of water heated to 48° or 50° C.) or two hours in copper sulphate (1 kg. per hectol. water).

Pamphlet 43 is concerned with *Sclerotinia libertiana* [*S. sclerotiorum*] which attacks a number of kitchen-garden plants, such as beans [*Phaseolus vulgaris*], peas, carrots, potatoes, beets, Jerusalem artichokes [*Helianthus tuberosus*: ibid., xv, p. 421], cabbage, lettuce [ibid., xvii, p. 6], vegetable marrow, certain industrial crops like hemp [ibid., xv, p. 97], and is occasionally found on vines [ibid., xiii, p. 746], plums, almonds, figs, and citrons [cf. ibid., xvii, p. 15]. Preventive measures [which are indicated] are more effective than curative treatments against this pathogen.

In pamphlet 44 an account is given of the mildew of Compositae, chiefly romaine lettuce and artichoke [*Cynara scolymus*], caused by *Bremia lactucae* [ibid., xv, p. 420]. Copper-containing mixtures may safely be applied to artichokes before heading, but are inadvisable in the case of lettuce on account of their liability to stain the sensitive foliage. *Leveillula* [*Oidiopsis*] *taurica* [ibid., xvii, p. 15], the agent of white mould of artichokes [*C. scolymus*] (pamphlet 45) and other market-garden crops, such as tomatoes and eggplants, is amenable to control by regular applications of an alkaline Bordeaux mixture.

Pamphlet 46 deals with pea bacteriosis (*Pseudomonas pisi*) and its control by thirty minutes' to one hour's immersion of the seed in 0·5 per cent. formalin.

In pamphlet 47 vine downy mildew (*Plasmopara viticola*) is discussed at some length. Among the most resistant varieties under local conditions are York-Madeira, Couderc 132–11, 7120, and 3, Noah, Clinton, Black Defiance, Seibel 4121, 4762, 5455, 5813, 5912, 6468, 4986, 5213, 880, 1000, 1070, 1077, 2859, B.S. 872, S. 5860, 5061, and 5409, Aramon-Rupestris-Ganzin No. 1, and C. 106–46.

Pea melanosis (*Mycosphaerella pinodes*) [ibid., xvi, p. 435] is described in pamphlet 48. It is best controlled by the exclusive use of seed from healthy pods, four- to five-year crop rotation, and other cultural measures. Similar practices are recommended in pamphlet 50 against *Phytomonas* [*Bacterium*] *medicaginis* var. *phaseolicola* on beans (*Phaseolus*) [*vulgaris*: ibid., xvii, p. 13 *et passim*], except that in the case of this parasite a triennial crop rotation suffices to eliminate infection from the soil. The varieties reputed to be resistant to the disease in Europe have all been attacked in Morocco.

BLANK (L. M.). **Fusarium resistance in Wisconsin All Seasons Cabbage.** —*J. agric. Res.*, lv, 7, pp. 497–510, 3 figs., 4 graphs, 1937.

This is a full report of the author's studies, both in the field and in the greenhouse under partial and full control of soil temperatures, on the nature and inheritance of resistance to *Fusarium conglutinans* [*R.A.M.*, xvi, p. 159] in the Wisconsin All Seasons cabbage variety, a brief reference to which has been noticed from another source [ibid., xv, p. 3]. This variety was found to carry at least two types of resistance, the first of which (type A), due to a single dominant gene, is apparently similar to that described for other varieties of cabbage, Brussels sprouts, and kohlrabi, and remains effective at relatively high soil temperatures (about 20° C.); it was demonstrated in the progenies of many of the plant selections, and was transmitted through the three generations of the material studied. The second (B) type is apparently similar to that described for Wisconsin Hollander [ibid., xiv, p. 732], and is genetically complex; it is most effectively expressed at the lower soil temperatures. In the field tests, the efficacy of type B resistance varied in the several progenies, certain of which showed no external symptoms of the disease, while others developed a considerable percentage of mild infection, and still others promptly succumbed to the disease. In the greenhouse experiments with controlled soil temperatures, the expression of type B resistance was suppressed, all progenies being eventually killed. Under conditions of semi-controlled or fluctuating temperatures, it was partially expressed, resulting in a delayed and less severe development of yellows symptoms. The greenhouse tests also indicated the existence of various types of type B resistance.

In the Wisconsin All Seasons variety the severity of yellows is considered to be dependent on the genetic make-up of the plants with reference to type A and type B resistance, on soil temperatures, and possibly also on other conditions influencing the expression of resistance.

PARBERY (N. H.). **Magnesium deficiency in Cabbages and Cauliflowers.**—*Agric. Gaz. N.S.W.*, xlviii, 10, pp. 556–558, 577, 5 figs., 1937.

A diseased condition, suggestive of magnesium deficiency, of cabbages and cauliflowers, is stated to be prevalent, especially in seed-beds, in commercial horticultural holdings at Revesby, Bankstown district, in New South Wales, on very acid soils deficient in the element. In the early growth stages of the plants the trouble appears as yellowish to yellowish-green blotches between the veins, gradually grading into the normal green tissue bordering the mid-rib and the main lateral veins; the seedling leaves are thick and brittle and tend to curl inwards. In

older plants, larger yellow blotches occur between the veins, and in the most severely affected leaves the blotches coalesce to form yellow bands demarcated by the main lateral veins. Cabbages may be distorted, the leaves becoming thickened and tending to curl into ladle-like shapes. Comparative analysis of healthy and diseased plants showed that the magnesium content was 0·95 and 0·72 per cent., respectively. It is believed that the condition may be controlled by applications to the soil of magnesium-bearing limestone or dolomite.

Cook (H. T.). **Spinach and Cabbage seed treatment.**—*Bull. Va Truck Exp. Sta.* 96, pp. 1491–1510, 5 figs., 1937.

Experiments have been in progress during the last five years to determine the relative value of a number of fungicidal dusts in the control of [unspecified] fungi on cabbage and spinach seed [*R.A.M.*, xiv, p. 673]. The 1935 tests showed that, even under conditions specially conducive to seed decay, satisfactory spinach stands could be obtained with 20 or 30 per cent. less seed than is generally used, provided suitable treatment is given. As regards the rate of application, 1·5 per cent. was found to be about the correct dosage for the various copper and zinc preparations used, affording adequate protection without leaving much excess dust in the treating machine or seed drill.

Zinc oxide (Mallinckrodt's), red copper oxide (in the form of cuprocide [ibid., xv, p. 552] manufactured by the Rohm and Haas Co.), and vasco 4 containing zinc oxide and hydroxide and costing only about half as much as red copper oxide, proved uniformly effective for the purpose in view. AAZ special zinc oxide (which costs about a third of red copper oxide) and copper oxychloride (both supplied by Rohm and Haas, the latter under the name of copper compound KB) gave good control in some of the plots but were not as consistently reliable as the foregoing, while fungex (Metals Refining Co.) was less effectual. An old, dark brown, red copper oxide proved to be as toxic to the seed-rotting fungi as a fresh, bright sample, indicating that considerable oxidation of the compound may take place without impairing its antiseptic properties. Semesan proved inferior to any of the other materials used in the tests on spinach seed, but ceresan gave very promising results and merits further trial. Microfyne graphite [ibid., xvi, p. 720] (Joseph Dixon Crucible Co.) exerted no fungicidal action itself but reduced the amount of friction caused by the various seed treatments and the wear and breakage of the drills, and its continued use is therefore recommended.

The incidence of spinach seed decay is most extensive in soils with a moderate to high moisture content and a similar temperature range at and immediately following planting—conditions that usually prevail at the time of early autumn sowing.

Seed decay in cabbage was prevented by zinc oxide, red copper oxide, vasco 4, and semesan, but red copper oxide is liable to cause stunting besides being less toxic than zinc oxide or vasco 4 to the organisms concerned, while the two latter, unless mixed with graphite, caused severe damage to the seed by friction.

It is apparent from these tests that the treatments under investigation are specific for certain kinds of seeds. Spinach may be safely

treated with red copper or zinc oxide, whereas the former may injure cabbage; peas, on the other hand, are stimulated by red copper but stunted and yellowed by zinc oxide.

OSVALD (H.) & PETERSSON (G.). **Experiments with boron against heart rot.**—*Ann. agric. Coll. Sweden*, iv, pp. 233–258, 4 figs., 1 map, 1937.

This is a detailed account of experiments in the control of heart rot of sugar beets in Sweden by means of boron, a summary of which has already been noticed from another source [*R.A.M.*, xv, p. 416].

SCHMIDT (E. W.) **Der Wurzelbranderreger Phoma betae als Blattfleckenpilz der Rübe.** [The root rot agent *Phoma betae* as leaf-spot fungus of the Beet.]—*Dtsch. Zuckerindustr.*, lxii, 44, pp. 988–989, 5 figs., 1937.

Positive results were obtained at Kleinwanzleben in inoculation experiments on beet leaves with pure cultures of *Phyllosticta tabifica* from the foliage [*R.A.M.*, xiv, p. 396] and of *Phoma betae* from the stems [ibid., xvii, p. 90], thereby confirming the conclusion of Wollenweber and Hochapfel in their studies on *Phoma* [ibid., xvi, p. 105] that *Phyllosticta tabifica* is merely the late summer and autumn foliar phase of the *Phoma betae* spring root rot.

SCHMIDT (E. W.). **Zwei in diesem Jahre stark aufgetretene Blatterkrankungen der Zuckerrübe.** [Two leaf diseases of the Sugar Beet of widespread occurrence in the current year.]—*Dtsch. Zuckerindustr.*, lxii, 43, pp. 962–963, 2 figs., 1937.

Two relatively uncommon sugar beet leaf diseases were favoured by the alternations of hot weather with heavy rainfall or high atmospheric humidity prevailing in Germany during the summer of 1937, viz., *Cercospora* [*beticola*: *R.A.M.*, xv, p. 763] and *Alternaria tenuis* [ibid., xiv, p. 281], the former paving the way for infection by the latter. Considerable economic damage was caused by this exceptional coincidence of the two fungi under observation.

ZAUMEYER (W. J.) & WADE (B. L.). **Varietal reaction of Pea to Pea-streak virus 1.**—*Phytopathology*, xxvii, 10, pp. 1009–1013, 1937.

All the 47 pea varieties tested in the greenhouse in 1934 and 1936 for their reaction to streak virus 1 (a description of which is pending in *J. agr. Res.*) proved to be more or less susceptible, particularly Champion of England, Phenomenon, and Mammoth Melting Sugar, while Notts Excelsior and Little Marvel were not so severely attacked.

CANONACO (A.). **Un forte attacco di ruggine alla Lentichia ('Lens esculenta' Moench).** [A heavy attack by rust on Lentil (*Lens esculenta* Moench).]—*Riv. Pat. veg.*, xxvii, 9–10, pp. 281–285, 2 figs., 1937.

A brief account is given of a heavy outbreak, in 1937, of rust in an experimental field of lentils in the district of Palermo, where attempts are being made to introduce the commercial cultivation of this crop. By the characters of its uredo- and teleutospores, both of which were found on the lentil plants, the rust is referred to *Uromyces fabae* [*R.A.M.*

xvi, p. 207] which is stated to be very prevalent in Sicily on broad beans [*Vicia faba*]. If lentils are to succeed in Sicily, care should be taken to destroy soon after harvest all dead plants of broad beans, as well as all other hosts of the rust in the field, while applications of sprays during spring may also prove beneficial.

McWhorter (F. P.). **Cell inclusions in Onion yellow dwarf.**—*Phytopathology*, xxvii, 10, pp. 1027–1028, 1 fig., 1937.

The cell inclusions in fuchsin-stained material, fixed in aceto-formalin and mounted in dioxan, of California onion leaves affected by yellow dwarf [*R.A.M.*, xiv, p. 810; xvi, p. 725] were found to present no unusual structures but to consist of minute, rod-like structures enveloped with cytoplasmic trailings. The adjoining nuclei are readily distinguishable by the presence of characteristic reticulate structures reacting with greater intensity to fuchsin stains than the cytoplasm.

Bottomley (A[veril] M.). **Grape anthracnose.**—*Fmg S. Afr.*, xii, 137, pp. 338–339, 2 figs., 1937.

A popular account is given of the symptoms, etiology, and control of grape anthracnose (*Elsinoe ampelina*) [*R.A.M.*, xvi, p. 655], which is stated to be the most serious vine disease in the summer-rainfall areas of South Africa, where all the green organs—berries, leaves, stems, and tendrils—are liable to infection. Moisture and fairly high temperatures are essential for the germination of the spores whereby infection is perpetuated. Good control of *E. ampelina* may be obtained by a dormant application of iron sulphate (25 lb.) and sulphuric acid (1 pint) in water (50 gals.), followed in the spring, if necessary, by further treatments (two or more according to the severity of infection and weather conditions) with 4–4–50 Bordeaux mixture.

Rives (L.). **Nouvelles observations sur les champignons endophytes de la Vigne.** [Further observations on the endophytic fungi of the Vine.]—*Rev. Vitic., Paris*, lxxxvii, 2259, pp. 275–278, 1937.

The author states that his cytological studies of various organs of a number of vine varieties, both healthy and affected with court-noué, in which he strictly adhered to Ranghiano's [*R.A.M.*, xiii, p. 616] methods, have convinced him that the structures interpreted by that investigator as mycelium of an endophytic fungus, are artifacts [cf. ibid., xiv, p. 616]. Endophytic mycelium was observed, however, in the cortical tissues of the rootlets, but not in the other tissues of either healthy or diseased vines.

Gigante (R.). **Ricerche istologiche sulle omeoplasie crestiformi (enations) delle foglie di Vite affette da rachitismo.** [Histological researches on the crestiform homoplasia (enations) of Vine leaves affected with rachitism.]—*Boll. Staz. Pat. veg. Roma*, xvii, 2, pp. 169–192, 1 pl., 14 figs., 1937.

As a result of histological studies on leaf enations in Italian vines showing symptoms of 'rachitism' [regarded by Petri as distinct from 'arriciamento' (or leaf roll) (*R.A.M.*, xvii, p. 95) since no endocellular

cordons were present and the symptoms did not develop throughout the growing season], the author states that the enations start as a slight protuberance on the lower leaf surface due to the division of the subepidermal tissues of the young leaves. This protuberance enlarges, and develops palisade and spongy parenchyma, like a true leaf. Generally the enations develop in pairs, and the palisade tissues of the one may pass directly into the other or there may be transitional cells interposed, the arrangement of the tissues being inverse to that of the leaf bearing them. Sometimes two adjacent excrescences unite at the edges to form a cavity. In the diseased palisade cells a dense cytoplasmic bridge was sometimes observed, apparently continuous with the parietal layer of cytoplasm. Intracellular inclusions were present in the cells of the palisade tissue and those of the woody parenchyma. The author considers that these findings support Petri's view that the disease may be due to a virus, although in recent grafting experiments infection was not transmitted.

Branas (J.), Bernon (G.), & Levadoux (L.). **Note sur la transmission par le sol de la dégénérescence de la Vigne.** [Note on the transmission through soil of degeneration diseases of the Vine.]—*Rev. Vitic., Paris*, lxxxvii, 2258, pp. 263–268, 2 graphs, 1937.

The authors state that their observations at Montpellier [the results of which are tabulated] showed a direct relationship between the number of lesions caused on the roots of two French vine varieties (grafted on a wide range of American and hybrid stocks) by *Phylloxera* [*vastatrix* f. *radicicola*] and the incidence and severity of vine degeneration (comprising diseases known as court-noué, leaf roll [see preceding abstract], Reisigkrankheit [*R.A.M.*, xvi, p. 795], fasciation, and panachure [variegation]). It was further noticed that in mixed lots the removal of vines highly susceptible to *Phylloxera* caused a marked increase in the severity of degeneration symptoms in *Phylloxera*-resistant neighbouring stocks, owing to the migration of the insects to the latter. These findings are considered to suggest that the insect may be a vector of the degeneration diseases [cf. ibid., xiii, p. 492].

Bonnet (A.). **Chronique. La brunissure.** [Current events. 'Brunissure.']—*Progr. agric. vitic.*, cviii, 41, pp. 325–327, 1937.

The author states that in 1937 vineyards in France showed very little, if any, 'brunissure' [*R.A.M.*, xiv, p. 214], except for certain vine varieties in the southern provinces, which yielded heavier crops than the average for that year. The scarcity of the condition is directly correlated with the comparatively light crops of grapes gathered, and this fact supports the views of Ravaz who regarded the disorders as due to the depletion of the potassium in vegetative organs of the vine through overproduction of fruit.

Plant diseases. Notes by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlvii, 11, pp. 624–628, 6 figs., 1937.

Though barley stripe (*Helminthosporium gramineum*) was first observed in New South Wales many years ago in experimental plots it

was not recorded in a commercial crop until September, 1937, when it is stated to have caused damage in the Braidwood district of the State. A brief description is also given of crown rot in ornamental and vegetable crops, commonly caused by *Sclerotium rolfsii*. Many instances of severe loss from this disease have been noted in the past. Heat-treated tobacco dusts used for insect pest control have recently been tested as carriers of tobacco mosaic but were found to be non-infectious.

NOBLE (R. J.). **Australia: notes on plant diseases recorded in New South Wales for the year ending 30th June, 1937.**—*Int. Bull. Pl. Prot.*, xi, 11, pp. 246–247, 1937.

This report contains the following items in addition to information already noticed from other sources. A severe root and stalk rot of sorghum was caused by a species of *Colletotrichum*, and injury due to *Bacterium holcicola* [*R.A.M.*, xv, p. 280] was also recorded.

Lucerne was affected by witches' broom [ibid., xvi, p. 518] and a disorder apparently identical with dwarf (of virus origin) [ibid., xvi, p. 816], the latter observed for the first time in New South Wales. A witches' broom-like condition also occurred in soy-bean crops. Tomato spotted wilt and 'paper leaf', a disturbance of the spindle tuber type, were observed affecting potatoes. *Septoria depressa* was reported on Navel oranges [ibid., xi, p. 780] in inland irrigation areas. Banana 'squirter' disease (*Nigrospora sphaerica*) [or *N. musae*: ibid., xvi, p. 763] caused loss among fruits consigned to cooler regions.

MANNS (T. F.), DAVIES (F. R.), HEUBERGER (J. W.), & ADAMS (J. F.). **Department of Plant Pathology.**—*Rep. Del. agric. Exp. Sta., 1936–7* (*Bull.* 207), pp. 36–45, 1937.

Further work at Delaware on the masking of peach yellows and little peach [*R.A.M.*, xvi, pp. 368, 621] in plums showed that, when the Elberta and natural peach seedlings were budded with material from various species of *Prunus* infected with yellows or little peach, the average percentage of infection with yellows was nearly equal for both hosts (60 and 57·5, respectively), whereas for little peach the figures were 19·7 and 33·8, respectively. The almond readily takes both diseases and certain Oriental plums may bear marked symptoms of them, while in others considerable masking may be present. The wild rootstock used for grafting plum (*P. myrobalana*) [*P. divaricata*] shows nearly complete masking of both conditions. Each virus was easily able to reach nursery plums when infected grafting stock of *P. divaricata* was used, and from these was carried to peaches by *Macropsis trimaculata*.

Typical foliage and twig infection by *Bacterium pruni* [ibid., xvi, p. 369] was noted on *P. othello*.

Seed from watermelons affected with wilt (*Fusarium* [*bulbigenum* var.] *niveum*) [ibid., xvi, pp. 369, 439] showed typical growth of the fungus when planted out after disinfection, confirming the view that infection in the field is seed-borne.

In spraying tests against apple scab [*Venturia inaequalis*] the following all gave greater percentages of clean fruit than Bordeaux mixture 4–8–100: coposil (3–100); Bordeaux 34 (1–100); Z-O (1·5 to 2–100);

copper phosphate, bentonite, and lime (4–4–8–100) [ibid., xvii, p. 193]; and a combination of 1 gal. lime-sulphur and ½ lb. Z-O per 100 gals. water.

The newer tomato varieties Marglobe, Master Marglobe, and Rutgers are more resistant to wilt [*F. bulbigenum* var. *lycopersici*] and early and late blights [*Alternaria solani* and *Phytophthora infestans*, respectively] than the older varieties grown in Delaware.

Brown (Nellie A.) & Gardner (F. E.). **Indoleacetic acid galls of a secondary type.**—*Phytopathology*, xxvii, 11, pp. 1110–1113, 2 figs., 1937.

In addition to the primary galls induced on Kidney bean [*Phaseolus vulgaris*] stems by smearing them with an indoleacetic acid and lanoline mixture [*R.A.M.*, xvi, p. 798], from 1 to 15 secondary galls arose at some distance from the site of application in response to an internal disturbance, possibly connected with a superfluity of growth substance. Crown gall is not usually regarded as a systemic disease because of the apparent absence of *Bacterium tumefaciens* from the tissues adjacent to the galls or from secondary excrescences. It is now evident, however, that the latter are due to the emission by the organism in the primary gall of a gall-stimulating substance which, as the experiments with indoleacetic acid showed, can move through the stem for considerable distances.

Dade (H. A.). **Swollen shoot of Cacao. Report on Mr. H. A. Dade's visit to the Gold Coast.**—*Sess. Pap. legisl. Counc. Gold Coast Colony* No. 5 of *1937*, 15 pp., 1937.

In this detailed, official report of his visit to the Gold Coast to investigate 'swollen shoot' disease of cacao [*R.A.M.*, xvi, p. 518], the author states that the extensive loss of trees in New Juaben and Eastern Akim is due to drought die-back, the result of extreme exposure to sun and wind during the dry season, brought about by the gradual disappearance of shade trees and surrounding forest, the effect of which is enhanced in this district by light, non-retentive soil. Swollen shoot symptoms [loc. cit.] are found, not very profusely, only on trees severely affected by drought die-back, and are merely secondary. They occur freely on the water-shoots which spring from the stumps of felled die-back trees. Sometimes, but not consistently, associated with swollen shoots are somewhat chlorotic, puckered leaves. The swellings are the result of hypertrophied secondary growth of the xylem, but until die-back necrosis supervenes, the tissues are otherwise healthy, and no parasite could be isolated from them. Necrotic die-back tissues, whether accompanied by swollen shoot or not, are always invaded by secondary fungi such as *Botryodiplodia theobromae* and saprophytes such as *Gliocladium roseum*, none of which can attack healthy tissue. The possibility of a virus origin is not excluded, but is thought to be unlikely, and it is considered that the swollen shoot phenomena are more probably due to an undetermined soil deficiency, occasioned by leaching of the soil by heavy rain as exposure increased.

The existing control operations [loc. cit.] were not effective, since the disorder continued to spread, and were aggravating the trouble by

exposing the remaining trees still more. It is therefore recommended that they should be discontinued, and replaced by an intensive programme of replanting of shade trees and windbreaks, to prevent further extension of die-back and to recondition the area, which is a valuable one. The need for re-establishment and maintenance of protection is not confined to the district in question, though most urgent there, but applies in varying degree to all cacao areas, deterioration of the forest being general. It is considered that the life of cacao orchards can be prolonged indefinitely if normal forest conditions are maintained; and notes are given on the material and methods to be employed in the replanting programme. Though others should be tried, *Samanea saman* is probably the most suitable quickly growing tree for shade purposes.

This Minnesota seed grain treater provides means for easily disinfecting seed on the average farm.—*Agric. News Lett.*, v, 9, pp. 154–156, 2 plans, 1937. [Mimeographed.]

A description is given of a seed-grain treater designed by M. B. Moore for use with disinfectant dusts. It consists of a horizontal proportioning trough which fits at one end into a vertical mixing chute with a series of baffle boards each pierced with a 2-in. hole. The apparatus must be mounted high enough for the bottom of the chute to clear the floor by the height of a grain sack, the free end of the trough being supported by a rope and pulley hung from the ceiling. In operating, the proportioning trough is filled with evenly spread grain sprinkled with the necessary quantity of disinfectant dust, then by raising the free end of the trough the grain is shot through the chute into bags.

HASSEBRAUK (K.). **Untersuchungen über die biologische Spezialisierung von Puccinia graminis tritici (Pers.) Erikss. et Henn. und Puccinia graminis avenae (Pers.) Erikss. et Henn. in Deutschland und Südeuropa.** [Investigations on biologic specialization in *Puccinia graminis tritici* (Pers.) Erikss. & Henn. and *Puccinia graminis avenae* (Pers.) Erikss. & Henn. in Germany and southern Europe.] —*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 65–70, 1937.

Twenty-four wheat black rust (*Puccinia graminis tritici*) collections from Germany, Hungary, U.S.S.R., Bulgaria, Greece, Italy, and Turkey were found to contain the physiologic races 40, 21, 17, 14, 34, and 75, with the addition of a new one, 145, which differed from the rest in its pathogenicity towards the varieties comprised in Stakman and Levine's original standard assortment [*R.A.M.*, ii, p. 158]. Races 40 and 21 were the most widely distributed. A number of collections from all the countries represented were attacked and destroyed by *Verticillium niveostratosum* and *Cephalosporium acremonium* [ibid., xvi, p. 237] before they could be tested on the differential varieties.

One Bulgarian and six German collections of *P. graminis avenae* yielded exclusively physiologic form 6 [ibid., xiii, p. 363].

The results of these studies are considered to support the hypothesis of a causal connexion between outbreaks of *P. graminis* in central and southern Europe.

Hassebrauk (K.). **Untersuchungen über die physiologische Spezialisierung von Puccinia triticina Erikss. in Deutschland und einigen anderen europäischen Staaten während der Jahre 1934 und 1935.** [Studies on physiologic specialization in *Puccinia triticina* Erikss. in Germany and some other European countries during the years 1934 and 1935.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 71–89, 1937.

Sixty samples of brown rust of wheat (*Puccinia triticina*), mostly of German origin supplemented by a few from Belgium, Finland, Czechoslovakia, Hungary, Bulgaria, Italy, Greece, and Turkey, yielded physiologic forms [*R.A.M.*, xvi, p. 732] 11, 14, 15, 16, 17, 20 (13), 31, and 68 in 1934, while in 1935 the material comprised, in addition to the foregoing, forms 19, 26, and 53 (68 being absent) and three new ones, herein designated A, B, and C; of these A, occurring sporadically throughout Germany, virulently attacked all the eight varieties of the standard assortment [ibid., xi, p. 288] except Mediterranean, which showed some resistance, B (Breslau and Lübeck) attacked Mediterranean severely and infected four others, and C (Württemberg, once only) was highly pathogenic to Malakoff and infected six others, mostly in a mild form. As in the case of *P. graminis*, a number of samples of *P. triticina* were destroyed by *Verticillium niveostratosum* [see preceding abstract] before they could be tested.

The most widely distributed of the foregoing races in Germany were 11, 14, 16, and 20 (with which Scheibe's 13 [ibid., viii, p. 366] is considered to be identical); besides A, B, and C, races 26, 31, 53, and 68 were detected for the first time in Germany and constitute new records for the European continent, while races 18, 21, and 22 did not occur during the period under review. The physiologic races were distributed among the foreign collections of *P. triticina* as follows: 11 and 16 in Belgium, 11 and 20 in Finland, 15 and 20 in Czechoslovakia, 11, 15, and 20 in Hungary, 14, 17, and 20 in Bulgaria, 11, 14, 15, and 20 in Italy, 14 and 20 in Greece, and 11, 14, 15, 18, 19, 20, 25, and 31 in Turkey. It is apparent from a study of previous observations on the composition of the brown rust races in Germany that a change has taken place of recent years, the outstanding features of which are the great increase in the prevalence of the formerly sporadic 16 and the simultaneous marked decline in the incidence of 15. The results of the present investigations lend no support to Scheibe's theory [ibid., ix, p. 767] that definite laws govern the geographical distribution of the brown rust races in Germany and probably elsewhere in Europe. On the contrary, the qualitative and quantitative composition of the race flora of a given region must be expected to undergo periodical alterations in response to varying meteorological conditions, the cultivation of predominantly resistant or susceptible varieties, and the incalculable development of new mutant races.

There has, in the writer's opinion, been a tendency of late years to create new races of *P. triticina* on inadequate grounds, many of those described showing no well-defined differential pathogenicity towards the standard varieties and merely confusing the main issues from the plant-breeder's standpoint, which in a matter of this kind should outweigh purely systematic interests.

In an appendix attention is briefly directed to some recent Russian contributions to the subject of brown rust specialization [ibid., xvi, p. 163] appearing while the present work was in the press.

Sibilia (C.). **Esperienze di lotta diretta contro le ruggini del Grano con 'Asporital' d'Amico nel 1937.** [Experiments on the direct control of Wheat rusts with d'Amico's 'asporital' in 1937.]—*Boll. Staz. Pat. veg. Roma,* N.S., xvii, 2, pp. 267–272, 1 fig., 1937.

Villa Gloria wheat near Alessandria dusted during the second week of May, 1937, before the appearance of *Puccinia glumarum,* with a copper dust 'asporital' subsequently had a 'specific weight' [weight of the grain per hectol.] of 77 kg., as against one of 72 kg. for the untreated control. No observations could be made on the fungicidal value of the dust as the experiment was interrupted by adverse weather conditions.

In another locality, 13,270 sq. m. of Virgilio wheat were dusted with the same preparation (by one man using a hand dusting machine) on 25th April, 10th and 22nd May, and 5th June, 43,330 sq. m. remaining untreated as a control. The dusted wheat showed practically no infection, and yielded 23·37 q. of grain per hect. of specific weight 79·1 kg. (average); the untreated wheat showed slight but well-marked infection by *P. graminis, P. triticina,* and *P. glumarum* and yielded only 20 q. of grain per hect. of specific weight 78·3 kg. Allowing for the cost of material and labour, the treatment gave a net profit of 439·25 lire per hect.

Nelson (O. A.) & Leukel (R. W.). **Experiments with certain copper compounds as bunt fungicides.**—*Circ. U.S. Dep. Agric.* 452, 8 pp., 1937.

Tabulated results are given of field tests (following preliminary laboratory tests) of a number of copper compounds in the control of bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] carried out during the period 1930–5. Copper carbonate was used as a standard of comparison. Basic copper sulphate, high-grade copper carbonate, copper sulphate-aniline (containing 20·6 per cent. copper and prepared by adding aniline to a solution of copper sulphate) and possibly copper chloride-aniline (prepared by adding aniline to a solution of cupric chloride until no more aniline reacted) were found in general to be superior to all other copper compounds tested as regards cost, efficiency, and freedom from objectionable characters. Copper oxychloride besides being somewhat corrosive to metal is slightly less efficient than copper carbonate, the phosphate and silicate were not consistently effective, dehydrated copper sulphate and copper sulphate monohydrate were effective when finely powdered but became lumpy from moisture absorption, while cupric oxide was inferior to the carbonate, and cuprous oxide though effective is more abrasive. Basic copper sulphate besides being somewhat cheaper than the carbonate is apparently equal or even superior to it in effectiveness. A proprietary dust containing 5 per cent. of ethyl mercuric phosphate was as good as any of the copper dusts tested.

Voss (J.). **Zur Methodik der Prüfung von Weizensorten auf ihre Widerstandsfähigkeit gegen Steinbrand (Tilletia tritici).** [On the technique of testing Wheat varieties for their resistance to bunt (*Tilletia tritici*).]—*Pflanzenbau*, xiv, 4, pp. 113–153, 3 figs., 5 maps, 1937.

Particulars are given of two new methods, applicable, respectively, to summer and winter wheats, for the testing of varietal reactions to bunt (*Tilletia tritici*) [*T. caries*] in the greenhouse in relatively short periods, six to eight weeks in the case of summer varieties and about twice as long for winter ones. The varying degrees of pathogenicity of the several collections of the fungus can also be detected by means of the greenhouse technique, which has been used for three years at the Biological Institute, Berlin-Dahlem, side by side with the customary field tests.

The summer wheat seed-grain, mixed with 0·3 to 0·5 per cent. by weight of inoculum, is placed in pots containing 2 parts of sand and 1 of loam, with the addition of 500 gm. lightly moistened peat mould per 10 kg. of soil mixture, and various fertilizers. A temperature of 16° to 17° C. has generally been found most suitable for germination, after which the pots are kept at 20°, rising to 28° at times during the summer. The plants are watered twice a week with 1 per cent. hakaphos. From dusk till 5 a.m. the plants are irradiated with Nitra incandescent lamps (350 watt per sq. m.) suspended above them.

The winter wheat seed-grain is inoculated with 0·5 per cent. bunt spores of varying origin, germinated in a cellar at 10·5°, transferred to daylight at 10° to 13°, and then after ten days placed in a refrigerator (2·4° to 5·8°) to induce flowering before removal to the greenhouse.

Generally speaking, the infection percentages in summer wheat were higher in the greenhouse than in the field, whereas in the case of the winter varieties the figures were roughly parallel. In agreement with previous workers, the writer found a high degree of resistance in the summer varieties Ohio, Garnet, and Hope, and also in Heine's selection of *Triticum durum*; Peragis was highly susceptible (100 per cent. infection) and a number of other varieties intermediate in their reaction. Among the winter wheats General von Stocken proved to be highly susceptible (90·7 per cent. infection), while varying degrees of resistance were shown by Heil's Dickkopf, Hohenheimer 77, and the two new selections 827/35 and 828/35.

The bunt collections from different localities varied in their pathogenicity towards the wheats used in the tests, attack by that from Harleshausen, for instance, being generally mild while the Breslau, Hamburg, Munich, and Stettin strains caused heavier infection.

Millikan (C. R.) & Sims (H. J.). **The reactions of Wheat varieties to flag smut.**—*J. Dep. Agric. Vict.*, xxxv, 10, pp. 514–520, 4 figs., 1937.

The losses caused by flag smut of wheat (*Urocystis tritici*) in Victoria [*R.A.M.*, xvi, p. 664] are stated to have declined appreciably of recent years owing to the extended use of resistant varieties. From 1931 to 1936 varietal reaction trials were held, using the susceptible Free Gallipoli as a check and calculating all results on a comparative basis

of 100 per cent. infection in this variety. Standard errors were computed separately for the susceptible (50 per cent. infection or over) and resistant (under 50 per cent.) groups. This method indicated the very low significance of a single result, especially in the case of susceptible varieties. The following varieties, besides a number of Ghurka and Rajah and Gallipoli hybrids, were found to be resistant: Dindaloa, Red Rock, Nabawa, Cedar, Geeralying, Carrabin, Sutton, Florence, Forward, Dan, Sunset, Bencubbin, Dundee, Sword, Ghurka and its selections 228T and (W595, 05), Telfords, and Totadgin. In this connexion it is of interest to note that certain selections of the resistant variety Ghurka (susceptibility figure 17) are very susceptible (103 and 76). Full details are given of a series of inoculation experiments, the outcome of which definitely confirmed previous observations as to the occurrence of suppressed infection in semi-resistant varieties, occasioning heavier losses than external symptoms would denote. Early and deep sowing was found to favour infection by *U. tritici*, as well as the use of a heavy spore load (1 per cent.) for the inoculum.

SAMUEL (G.) & GREANEY (F. J.). **Some observations on the occurrence of Fusarium culmorum on Wheat.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 114–117, 1937.

Fusarium culmorum [*R.A.M.*, xvi, p. 308] was found about harvest time in 1934 to be present at the Rothamsted Experimental Station on the roots and bases both of healthy wheat plants and of those affected with whiteheads (*Ophiobolus graminis*) [ibid., xvi, p. 736], and periodic observations were accordingly made in 1935 at Rothamsted, St. Albans, and Cambridge on the progressive invasion of the roots and crowns of wheat plants by fungi from blossoming to maturity. The crops in all the three experimental fields were among the healthiest in the respective districts and gave no indication of having suffered from seedling diseases, but *F. culmorum* was isolated from a few specimens in every field at the time of the first sampling. While at Rothamsted the incidence of the fungus decreased as the season advanced, in the other two fields it increased markedly, until just before harvest 70 per cent. of the plants examined showed its presence on stem base or roots. The same percentage of infection was found in the stubble at St. Albans two weeks after harvest, while at Cambridge it was present in every one of 50 random stubble samples taken three weeks after harvest. The crops, nevertheless, gave excellent yields, and the grain at Cambridge filled remarkably well. The average disease ratings, obtained in greenhouse tests of the pathogenicity to wheat seedlings of the strains of *F. culmorum* from the three fields, were 21 (ranging from 9 to 40) for the 13 isolates of *F. culmorum*, 99 for three isolates of *O. graminis*, and 7·5 for the controls.

The fact that, although evidently present in the soil of the three fields, *F. culmorum* did not exert an appreciable parasitic effect on the wheat plants, is in contrast to the fairly frequent reports, especially from the north of England, of appreciable damage caused by it to the crops; it may be significant that in all three fields, in which it caused no apparent injury, the soil is a slightly alkaline clay.

Garrett (S. D.). **Soil conditions and the take-all disease of Wheat. II. The relation between soil reaction and soil aeration.**—*Ann. appl. Biol.*, xxiv, 4, pp. 747–751, 1937.

An account is given of experiments, the results of which showed that the retarding effect of high soil acidity on the growth of *Ophiobolus graminis* along the roots of wheat seedlings [see preceding abstract and *R.A.M.*, xvi, p. 306] is almost completely neutralized by forced aeration of the soil. In soil adjusted to P_H 5·9 the fungus made a growth along the seedling roots of $8\pm1{\cdot}8$ mm. in 14 days, whereas in the same soil subjected to forced aeration it grew $31\pm3{\cdot}4$ mm., as compared with $35\pm3{\cdot}1$ mm. in aerated soil adjusted to P_H 8. Comparable results were also obtained in two other series of tests, in one of which the experiments were made with two field soils both with P_H 5·2 and a third one with P_H 8, the figures for the non-aerated soils being 5, 6, and 18 mm. respectively, and for the aerated 22, 26, and 23 mm. respectively. These findings support the suggestion made in the first paper of this series [loc. cit.] that the retardation of the growth of *O. graminis* along the host roots in acid soils is due to the accumulation in the latter of respiratory carbon dioxide.

Young (P. A.). **Sclerotium blight of Wheat.**—*Phytopathology*. xxvii, 11, pp. 1113–1118, 2 figs., 1937.

From 1928 to 1935 *Sclerotium fulvum* destroyed a minimum of 100 to 500 acres of wheat annually in Gallatin County, Montana [*R.A.M.*, xiii, p. 434], except in 1934, when the snow with which the fungus is normally associated was almost absent. In 1931–2 the following were among the varieties killed by the fungus: Albit, Cooperatorka, Fulcaster, Harvest Queen, Hussar, Kanred, Kawvale, Malakoff, Marquis, Mediterranean, Minhardi, Oro, Regal, Ridit, Sherman, and Turkey. Maize-meal agar cultures of *S. fulvum* grew only at temperatures near 0° to 5° C., a fact that explains the above-mentioned correlation between the development of sclerotial blight and the snow banks providing the requisite temperature and moisture conditions. Basidial formation, on the basis of which the species under discussion has been referred to *Typhula graminum* [ibid., xiv, p. 568], did not occur in the writer's experiments with sclerotia from wheat tissues and agar cultures, so the name *S. fulvum* is retained for the present. Turkey wheat covering nearly 20 out of 100 acres was destroyed by sclerotial blight in 1935, when *Thlaspi arvense* was also killed over a large wheat area. The fungus overwinters on wheat stubble and dead stems of *Sisymbrium altissimum* and *Chenopodium album*; volunteer wheat seedlings springing up in the vicinity were commonly found to be severely attacked by blight, showing *Sclerotium fulvum* to be a facultative parasite that increased abundantly as a saprophyte.

Straib (W.). **Die Bestimmung der physiologischen Rassen des Gerstenzwergrostes, Puccinia simplex (Kcke) Erikss. et Henn.** [The determination of the physiologic races of Barley dwarf rust, *Puccinia simplex* (Körn.) Erikss. & Henn.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 43–63, 1937.

A standard assortment consisting of ten barley varieties was used

for the determination of 14 physiologic races from 124 collections of dwarf rust (*Puccinia simplex*) [*P. anomala*] made during 1934–5, mostly in Germany [*R.A.M.*, xiv, p. 624] with a few from Holland, Sweden, France, and Turkey. The varieties were Grossklappige, Friedrichswerth Berg, Ackermann's Bavaria, Australian Recka, Egyptian four-rowed, Cruzat, Quinn C.I. 1024, Chilean D (C.I. 1433), Australian two-rowed, and Cuban. Ten of the 14 races were found to be new, while five collected by Hey, making a total of 19, were absent from the present series. The temperature selected as most suitable for the purpose in view was 16° C., at which the differential symptoms induced on the test varieties by the several physiologic races were most conspicuous, especially in the case of the more or less resistant varieties. The races seem to be distributed irregularly; though some are of more frequent occurrence than others, the latter may cause equally heavy damage by reason of their widely extended range.

Discussing the results of his experiments in relation to the practical problem of breeding barley for resistance to dwarf rust, the writer points out that the marked resistance of the Friedrichswerth, Berg (winter), and Bavaria (summer) varieties to a number of races is largely nullified by their susceptibility to others of wide distribution. The following four-rowed types, however, might be tested as parents in selection trials: JLB No. 3036 Spanish, JLB No. 3041 Palestine (both *Hordeum tetrastichum coerulescens*), and JLB No. 3119 Weider C.I. 1020 (*H. tetrastichum pallidum*), while Quinn C.I. 1024, Bolivia C.I. 1527, Peruvian C.I. 935, Callas C.I. 2440, Mecknos Moroc C.I. 1379, and Juliaca C.I. 1114 showed resistance to rust both in Mains's [ibid., x, p. 231] and the writer's experiments.

STRAIB (W.). **Untersuchungen über das Vorkommen physiologischer Rassen des Gelbrostes (Puccinia glumarum) in den Jahren 1935/36 und über die Agressivität einiger neuer Formen auf Getreide und Gräsern. Mit einer Nachschrift 'Unterschiede in der Keimungsweise der Uredosporen physiologischer Rassen von Puccinia glumarum'.** [Studies on the occurrence of physiologic races of yellow rust (*Puccinia glumarum*) in the years 1935–6 and on the aggressiveness of certain new forms on cereals and grasses. With a postscript: 'Differences in the mode of germination of the uredospores of physiologic races of *Puccinia glumarum*'.]—*Arb. biol. Anst. (Reichsanst.) Berl.*, xxii, 1, pp. 91–119, 1937.

By means of the cultivation of a yellow rust (*Puccinia glumarum*) 'indicator', Michigan Amber wheat, in various places in Germany and collections from other varieties and hosts, the author has surveyed the physiologic races of the rust occurring in the country and their geographical distribution [*R.A.M.*, xvi, p. 372], with special reference to barley.

Fifteen yellow rust races were differentiated in 1935 and eight in 1936 out of a total of 222 collections from widely separated localities; among these four were new. Seventy-three samples of foreign material from 32 places yielded 18 races during the two years. Up to the present 38 physiologic races of *P. glumarum* have been isolated and described, of which 20 are found in Germany. A key is furnished showing their

differential behaviour on a standard assortment of wheat varieties, two of barley (Heil's Franken and Fong Tien), one of rye (Petkus), *Hordeum murinum*, and *Agropyron repens*. Certain races tend to predominate in different countries. On wheat in Germany, for instance, race 7 is by far the most prevalent, followed at a considerable distance by 3, 5, and 8, whereas 18 and 20 are characteristic of the Balkans, and 2 and 3 of France and Belgium. Race 8 appears to be indigenous to Sweden. On barley in Germany only race 23 could be detected, the same one occurring also in Holland, Hungary, Bulgaria, and Turkey on this host. In France, however, barley is attacked by race 24.

Among the new races encountered in 1935–6 were three (28, 33, and 34) capable of infecting *A. repens*, *H. murinum*, and rye, respectively, and a non-specific form, 36. These races were virtually innocuous to German cultivated wheats but attacked a number of *Triticum* spp. with varying severity. On the other hand, most of the 152 German winter wheats tested were highly susceptible to two other new races, 26 and 27 (resembling race 7), while the 30 summer varieties showed moderate resistance. The South American race 30 was only slightly pathogenic to most of the German wheats. Some 500 German and foreign barleys were tested for their reaction to races 28, 33, 34, and 36, and like the wheats were uniformly immune or highly resistant. A number of other *Hordeum* species, however, reacted positively to inoculation with 28 and 33. Race 36 caused moderate infection on a number of *H.* spp. but 34 (rye) was only mildly pathogenic. Race 30 was somewhat more active in its attacks on German commercial barleys than on the wheats used in the tests. All the 37 rye varieties inoculated with race 34 proved to be highly susceptible, whereas they were immune from, or highly resistant to, 28 and 33. Races 28, 33, and 36 were tested for their pathogenicity to a number of wild grasses, of which some were attacked by all three, while various species of *Bromus* were immune from, or highly resistant to, each of the races. The grass range of the *A. repens* race 28 would appear to be scarcely wider than that of certain wheat and barley forms.

The occurrence on rye, *A. repens*, and *H. murinum* of specific races of *P. glumarum* is of considerable importance from the standpoint of geneticists and plant-breeders, inasmuch as these species are scarcely likely to serve any useful purpose in hybridization experiments. The same applies to *Haynaldia villosa* [*A. villosum*], which contracted moderately severe infection on inoculation with race 28. In this connexion it should also be noted that the *A. repens* and rye races, though unable to infect German wheats and barleys, are highly pathogenic to the American Kanred wheat. Caution in the use of foreign varieties for crossing is therefore indicated.

In culture on 2 per cent. agar the uredospores of race 2 germinated rather slowly, its maximum temperature being 23° C., while the corresponding figures for 9 and for 12 and 20 were 25° and 27°, respectively. At the optimum temperature of 12° race 23 germinated fairly rapidly, the process generally being completed in four hours; the maximum for this race is 27°. Similar relationships obtain in the case of 24 and 28, with a slightly lower temperature maximum. The germ-tubes of race 23 present a curly aspect, in contrast to the normal nearly straight

yellow rust type. A similar corkscrew appearance is exhibited by races 24 and 28 and in a less pronounced form by certain wheat forms. The germ-tubes of races 23, 24, and 28 disintegrate at an early stage. Germination tests may thus afford a supplementary method of distinguishing yellow rust races.

Smith (N. J. G.). **Leaf-scald of Barley in South Africa.**—*S. Afr. J. Sci.*, xxxiv, pp. 286–290, 1 fig., 1937.

An account is given of barley leaf blotch (*Rhynchosporium secalis*) [*R.A.M.*, xvii, p. 22], as it was found by the author to occur in a number of localities in the Cape Province, ranging from Stellenbosch to north of Grahamstown, at altitudes from near sea-level to well above 4,000 ft., this being the first record of the disease from South Africa. The fungus has not yet been found on wild grasses, and it is believed to be carried over from season to season by living barley plants which are to be found throughout the year; it was also observed causing conspicuous infection (not previously recorded) on the chaffs of barley grains, similar to those on the leaves, and even where there are no blotches on the chaffs small infections or spores present on the grain apparently serve as a source of infection for the new crop.

Straib (W.). **Die Bestimmung der physiologischen Rassen von Puccinia coronata Cda auf Hafer in Deutschland.** [The determination of the physiologic races of *Puccinia coronata* Cda on Oats in Germany.] —*Arb. biol. Anst. (Reichsanst.) Berl.*, xxii, 1, pp. 121–157, 1937.

Neither Frenzel's [*R.A.M.*, ix, p. 770] nor Murphy's [ibid., xiv, p. 435] standard assortment of oat varieties for the determination of physiologic specialization in *Puccinia coronata* [*P. lolii*: ibid., xvii, p. 24] having proved entirely adequate for the purpose, a new selection was adopted embodying some of the varieties used by each of these workers with the addition of four, *Avena sativa gigantea*, *A. fatua*, *A. strigosa*, and Uruguay (*A. byzantina*), raised at the Gliesmarode (Brunswick) Experiment Station.

Twenty-six collections of the aecidial stage of the rust from *Rhamnus frangula* failed to infect any of the oat varieties inoculated; of 21 from *R. cathartica* two attacked v. Lochow's yellow oats normally and this species further yielded a race of *P. lolii* non-specific for *A. sativa*. A race with similar infective capacities was also isolated from *R. aspleni-folia*. From 144 collections of the uredo stage of *P. lolii* in 104 localities on *A. sativa* and *A. fatua*, 139 physiologic races were isolated in addition to the three from *R. cathartica*.

Temperature relations were found to play an important part in the development of crown rust. Physiological race determination trials are best conducted at 18° C., at which point the differences in reaction of the standard varieties are most clearly expressed, but resistance tests should also be made at a higher and lower temperature range. A marked tendency to enhanced susceptibility was observed at 23° to 25°. Practically all the 320 varieties of oats used in the tests proved to be susceptible to the several races with which they were inoculated, as also were most of the other *A.* spp. included, so that there is little hope of discovering resistant forms. *A. fatua* serves as a reservoir of crown

rust inoculum, harbouring races specific and non-specific for oats. There was very little difference between these two groups in respect of their pathogenicity to wild grasses, and Eriksson's and Klebahn's special forms cannot be maintained. Furthermore, on the ground of experimental results obtained by American workers and also on morphological grounds, as well on the basis of their host range on grasses, the author concludes that the separation of *P. coronata* Corda into *P. coronata* (Cda) Kleb. and *P. coronifera* Kleb. is untenable [loc. cit.].

Further tests (described and tabulated in an appendix) confirmed the results of previous observations as to the relative unimportance of *R.* spp. (other than *R. cathartica*) in the epidemiology of crown rust of oats. *R. frangula* harbours races that are not specifically aggressive towards cultivated oats but may attack them on occasion, and the same applies to *R. asplenifolia* and *R. tinctoria.*

Straib (W.). **Flughafer als Zwischenträger des Kronenrostes.** [Wild Oats as an alternate host of crown rust.]—*NachrBl. dtsch. PflSch-Dienst*, xvii, 11, p. 89, 1937.

Attention is drawn to the widespread occurrence of wild oats (*Avena fatua*) heavily infected by crown rust (*Puccinia coronata*) [*P. lolii*: see preceding abstract] in the beet and potato fields of south Germany and other parts of the country in 1936 and 1937. The plant acts as a reservoir of infection and constitutes a serious menace to the autumn green fodder oats crop, so that measures for its eradication are urgently indicated.

Reed (G. M.) & Stanton (T. R.). **Inheritance of resistance to loose and covered smuts in Oat hybrids.**—*J. Amer. Soc. Agron.*, xxix, 9, pp. 997–1006, 1937.

In two crosses between oat varieties (Victor × Seizure and Victor × Scottish Chief, respectively) in which both parents were susceptible to loose smut (*Ustilago avenae*) [*R.A.M.*, xvii, p. 24], a high degree of susceptibility was obtained in both the F_2 and F_3 generations. The variety Victor was susceptible to covered smut (*U. levis*) [*U. kolleri*] while the other parents were resistant, and the F_2 and F_3 data indicate a monohybrid inheritance for resistance to this disease.

In five crosses in which one common parent, Monarch, was susceptible to covered smut and resistant to loose smut, while in the others (Gothland, Rossman, Danish, Seizure, and Scottish Chief) the relationship was reversed, the F_3 data clearly denote an independent inheritance of resistance to the two diseases, probably controlled by distinct single factors.

In a further cross between Danish Island and Monarch, the former very susceptible to *U. avenae* and slightly so to *U. kolleri*, a single-factor relationship for resistance to loose smut, with resistance dominant, was also indicated. In the case of covered smut, however, susceptibility apparently predominated.

Brandwein (P. F.). **Experiments on latent infection of resistant varieties by the loose and covered smut of Oats.**—*Bull. Torrey bot. Cl.*, lxiv, pp. 433–444, 1937.

Under controlled conditions in the greenhouse and in the field

experiments were carried out on the Black Mesdag, Markton, Scottish Chief, Early Champion, Gothland, and Monarch varieties of *Avena sativa*, the Fulghum variety of *A. byzantina*, as well as on strains of *A. strigosa* and *A. brevis* to test the hypothesis that covered smut (*Ustilago levis*) [*U. kolleri*: *R.A.M.*, xiv, p. 436] and loose smut (*U. avenae*) [ibid., x, p. 722], present as non-sporulating infection, may affect resistant varieties. Plants of such varieties raised from seeds previously dehulled and examined for injury, when inoculated with physiologic races of the smuts to which they were resistant, were not affected either in their yield, height, or number of culms, nor was there any difference in the dates of heading and ripening. Cytological investigations on inoculated resistant plants showed that the mycelium does not penetrate farther than the coleoptile and has no inhibiting effect on growth, whereas in the susceptible varieties it penetrates rapidly to the growing point.

Leitzke (B.). **Infektionsversuche mit Haferflugbrand-Sporen-Gemischen.** [Inoculation experiments with spore mixtures of loose smut of Oats.]—*Phytopath. Z.*, x, 5, pp. 504–553, 4 figs., 1937.

This is an exhaustive, tabulated account of the writer's inoculation experiments on ten standard oat varieties with spore mixtures of six collections of loose smut (*Ustilago avenae*) [*R.A.M.*, xv, p. 354], of which 1, 4, and 5 originated in Minnesota, 2 on *Avena fatua* (Halle), and 3 and 6 on white oats. Collection 1 attacked only the Eckendorf variety, 2 Eckendorf and Petkus, 3 Eckendorf and Gopher, 4 Eckendorf, Petkus, and Gopher, 5 Eckendorf, Gopher, and Lischow Early, and 6 Eckendorf, Petkus, Gopher, and Lischow Early.

The use of mixed inoculum produced the most divergent results. In 55 out of 145 cases there was no modification of pathogenicity, the incidence of infection being as high as that obtained with single inoculations with the most virulent strain. In 44 instances there was no immediate change in pathogenicity, but inoculations with the mixed progeny resulted in a decline of infection. This was already apparent at the outset of the inoculations in a further 18 cases, the decrease being maintained or even intensified in tests with the mixed progenies. In 9 instances a low incidence or absence of infection at the first inoculation was subsequently followed by a rise. Mixed inoculations resulted in an immediate increase of infection, succeeded by a decline in 10 cases, and in 5 the original increase was maintained. Only in 4 cases did infection result from inoculation with mixtures of strains which were individually non-pathogenic, the virulence thus acquired being maintained or intensified in the mixed progenies.

Among the factors involved in these changes in pathogenicity may be mentioned the variable mode of inheritance of aggressiveness, the redistribution of the proportion of aggressive forms by the crossing of spores of high and low degrees of virulence, the development through hybridization of new combinations with fresh faculties for pathogenicity, the mode of reproduction of the fungus, the varying numbers of spores of divergent germinative capacity participating in the mixtures, and the stronger or weaker tendency to sporidial fusion and differing mycelial growth rates. From a study of monosporidial lines isolated

from mixtures of the above-mentioned collections of *U. avenae*, the latter would appear to represent a blend of physiologically distinct races with predominantly heterozygous spores.

In supplementary inoculation experiments 35 new collections were tested on 14 varieties for pathogenicity, which was found to be mostly of a mild order. No correlation could be discerned between the locality of origin of the collections and their infectivity. The Buddha variety showed a high degree of resistance in tests in 1935 and 1936, and may be used as a parent in the breeding of smut-free forms.

The following are among the practical considerations arising out of these studies. The testing of selected oat lines for resistance to *U. avenae* must not be conducted solely with spore mixtures owing to the possibility of reduced infection from these sources. It is recommended that oat populations should be inoculated, as heretofore, with spore mixtures, and the selected lines inoculated singly with highly aggressive strains of the smut, those remaining immune in this test being further subjected to inoculation with a virulent spore mixture.

Rademacher (B.). **Kupfergehalt, Kupferbedarf und Kupferaneignungsvermögen verschiedener Hafersorten als Grundlage für die Züchtung gegen die Heidemoorkrankheit widerstandsfähiger Sorten.** [The copper content, copper requirement, and assimilation capacity for copper of different varieties of Oats as a basis for the breeding of varieties resistant to the reclamation disease.]—*Z. PflKrankh.*, xlvii, 11, pp. 545–560, 1 fig., 1937.

The author tested 231 varieties of oats at the Bonn Phytopathological Institute, Germany, in order to establish their resistance to the reclamation disease and found a group of early ripening black moor oats, grown on copper-deficient soils in the north-west of Europe [*R.A.M.*, xvii, p. 104], to be specially resistant.

Experiments were carried out with Probstei, Mahndorf, Victoria white II, von Lochow's yellow (susceptible), and Rotenburg, Dutch Black President, and *Avena strigosa* (resistant) on normal and various types of copper-containing soils over a period of two years. It was found that the susceptible varieties on normal soils never showed a higher copper content than the resistant. On the contrary, the latter show a greater copper content than the former. Results obtained under extremely variable conditions showed that the normal copper content varies in varieties of *A. sativa* from 3·06 to 7·26 mg. in straw and 4·19 to 14·17 mg. in grain per kg. dry substance and in *A. strigosa* from 5·73 to 9·46 mg. in straw and from 8·79 to 12·26 mg. in grain. But whereas the differences in copper content between grain and straw are small in the susceptible varieties, they are considerable in the resistant ones and *A. strigosa*, the latter having a greater capacity for storing copper in the grain than the former. It is concluded that differences in resistance cannot be explained by variations in the copper requirements of the varieties. The results of several pot experiments showed rather that the resistant varieties are able to extract larger quantities of copper from copper-deficient soil than the susceptible varieties—0·127 mg. and 0·0387 mg. per pot, respectively. It appears, therefore, that it is the greater capacity for assimilation of copper in

certain varieties of *A. sativa* and in *A. strigosa* which is responsible for their resistance to the reclamation disease. The copper content is a specific, heritable varietal character and the recognition of the importance of the capacity for copper assimilation should prove of value in the breeding of resistant varieties.

FLEISCHMANN (R.). **Einige Erfahrungen über Maisbrand in Ungarn.** [Some observations on Maize smut in Hungary.]—*Pflanzenbau*, xiv, 5, pp. 199–206, 1937.

The writer's protracted observations on maize smut [*Ustilago zeae*] in Hungary [*R.A.M.*, xvii, p. 174] have shown that destructive attacks on the cobs are comparatively rare, occurring in general in only 2 to 5 cases out of 1,000. Infection of the tassels is more prevalent. In years of heavy smut incidence, however, the figures for cob infection may be considerably higher; in 1937, for instance, the following counts were made per 1,000 plants: tassels 20, cobs 17, other organs 16. Interspersed among these rows were others in which the plants had been wounded by detasselling: infection counts showed that, out of 1,000 plants, 120 had been invaded at the site of the tassels, 30 through the cobs, and 70 through other parts. It is apparent, therefore, that the presence of open wounds, such as those inflicted by heavy summer thunderstorms, increases the likelihood of infection by five to six times [*R.A.M.*, xvi, p. 739]. Another factor contributing to severe smut infection is over-nutrition, especially with stable manure. The examination, in July, 1919, of maize stands of the same variety on rich and poor soil revealed a smut incidence of 106 and 21 per mille, respectively. In July, 1937, the number of diseased plants in black clay sand rich in humus ranged from 72 to 94 per 1,000, the corresponding figures for a light pale sand deficient in humus being 62 to 74.

In 1919 an attempt was made to combat the disease by the excision of the smut boils, 100 of which were carefully removed from 1,000 plants on 30th July. By 13th August 87 fresh boils had developed at the site of operation. In a test on particularly susceptible varieties the average percentage of *U. zeae* on 22nd July was 27·5 per cent.; all the boils were excised on that day and by 2nd August 32·7 per cent. of new ones had developed. It is thus evident that repeated excisions are necessary to keep the disease under control. In the case of tassel infections the results were more satisfactory, the single operation effecting a reduction from 15·5 on 22nd July to 7·8 per cent. after ten days.

Over a sequence of years periods of severe and mild smut infection may be distinguished, the averages for 1921–5, 1926–30, and 1931–5, for instance, being 102, 56, and 35 per mille. In 1936 the figure suddenly rose to 126 and in 1937 it amounted to between 70 and 80 as early as August. The average yields for 1921–5, 1926–30, and 1931–5 were, respectively, 127, 184, and 137 gm. of seed-grain per plant.

In a varietal trial in 1937 the incidence of *U. zeae* in Teneriffe maize was 666 per mille, whereas a new American selection remained completely immune. The results of previous tests (1927–9) also indicated the existence of consistent differences in varietal reaction to maize smut which were transmitted from year to year to the progeny. The record for susceptibility under local conditions is held by teosinte (*Euchlaena*

mexicana), regarded as the ancestor of maize, with 960 per mille infections, which affords a constant supply of inoculum.

The practicability of the control measures suggested by these observations is briefly discussed.

KINSEL (KATHERINE). **Carbohydrate utilization by the Corn Diplodias.**—*Phytopathology*, xxvii, 11, pp. 1119–1120, 1937.

A comparative study was made of the growth of two agents of maize ear rot, *Diplodia zeae* and *D. macrospora* [*R.A.M.*, xiv, p. 564], the latter known only from the south-eastern United States, Brazil, and Africa, on a modified Richards's solution with a number of different compounds as sources of carbon. *D. zeae* was found to make much more extensive growth than *D. macrospora* when the source of carbon was peptone, starch, lactose, maltose, sucrose, or combined sucrose and glucose, while the latter fungus was entirely unable to utilize three brands of glucose, cerulose, fructose (with or without glucose), galactose, and arabinose, on all of which the former developed more or less abundantly. The feeble growth of *D. macrospora* on culture media, such as potato dextrose, maize meal, and bean pod agars, as well as its incapacity to compete with *D. zeae* as a maize ear parasite, may thus be attributable to its inability to utilize the available sources of carbon.

WELLHAUSEN (F. J.). **Effect of the genetic constitution of the host on the virulence of Phytomonas stewarti.**—*Phytopathology*, xxvii, 11, pp. 1070–1089, 5 figs., 1 graph, 1937.

The effect of successive passages through resistant and susceptible hosts on the virulence of *Phytomonas* [*Aplanobacter*] *stewarti* was studied [*R.A.M.*, xiv, p. 751]. Strains of the organism were passed successively through seedlings of a highly resistant (yellow dent inbred, OSF), a highly susceptible (yellow, sweet Golden Bantam GB797), a very susceptible variety of teosinte [*Euchlaena mexicana*: ibid., xv, p. 573], and a series of grasses unrelated to maize.

Up to a certain point, presumably representing an equilibrium between the parasite and its particular host environment, successive passages through the highly resistant maize host increased the virulence of the initial strains for maize, whereas the same procedure in the case of the susceptible maize host decreased the virulence of the pathogen. Successive passages through the susceptible *E. mexicana* variety produced an effect comparable with that obtained by passage through the susceptible maize host, virulence being diminished both in respect of teosinte and maize. Successive passages through such highly resistant hosts, unrelated to maize, as Reed canary grass (*Phalaris arundinacea*), timothy (*Phleum pratense*), tall meadow oat grass (*Arrhenatherum elatius*), and proso or broomcorn millet (*Panicum miliaceum*), reduced the virulence of the bacterial wilt organism towards maize while increasing it in respect of the various grasses.

Cultures of *Aplanobacter stewarti* highly pathogenic to maize were very slimy or watery in growth on nutrient dextrose agar, whereas those of feeble infectivity were of a firmer habit.

VAN DER MERWE (A. J.) & ANDERSSEN (F. G.). **Chromium and manganese toxicity. Is it important in Transvaal Citrus growing?**—*Fmg S. Afr.*, xii, 140, pp. 439–440, 2 figs., 1937.

Citrus in the western Transvaal is subject to a condition known as 'yellow branch', characterized by the yellowing either of the veins or interveinal areas (in which case mottle leaf is closely simulated) of the foliage on one or two branches of a tree. In all cases this chlorosis of the leaves is followed by the dying-back of the tips of the branches, and sometimes of the roots, while the bark becomes loose and scaly. The fruits of diseased trees are small, frequently misshapen and seedless, greenish on one side, of inferior quality, and entirely worthless commercially. 'Greening' is the name applied to a disorder of citrus with very similar symptoms prevalent in the eastern Transvaal. Analogous conditions, suspected to be due to the same cause as yellow branch, have been observed in avocado, gardenia, and tobacco. The soil in which the citrus orchards affected with yellow branch are situated was found to contain 10 per cent. chromium, largely in the form of very insoluble chromite, occurring as an admixture in a black magnetite iron deposit, and an analysis of the leaves and fruits revealed up to 10 p.p. million of chromium, calculated on a dry-weight basis. The kraal manure extensively used in the orchards was also found to contain 1·363 p.p. million chromium. In the eastern Transvaal the black ore deposits in the irrigation furrows of the orchards contained a high proportion of manganese but very little chromium, and analyses of orange leaves revealed exceptionally large amounts of the former mineral. Further work is necessary, however, before yellow branch can be definitely attributed to chromium toxicity and greening to manganese toxicity.

HENK (H. J.). **Die Zerstörung von Kunstseiden durch Bakterien und Pilze.** [The destruction of artificial silks by bacteria and fungi.]—*Kunstseide*, xix, 10, pp. 326–327, 1937.

The resistance of artificial silks to bacterial and fungal attack depends on their degree of polymerization. All the artificial silks undergo much more rapid hydrolysis than native cellulose, and may in fact be completely transformed into glucose, of which the maximum yield from native cellulose is 30 per cent. The hydrolytic splitting of native cellulose can be initiated only by cellulase, whereas cellobiase (which occurs in numerous fungi, such as *Aspergillus* and *Mucor*), lichenases, and other hemicellulases may participate in the disintegration of artificial silk.

MASSEY (R. E.). **Seed disinfection, with special reference to Cotton.**—*Emp. Cott. Gr. Rev.*, xiv, 4, pp. 301–307, 1937.

In this brief review of the results obtained in several years' experiments in the Anglo-Egyptian Sudan on the disinfection of cotton seed against *Bacterium malvacearum*, the author points out that a desirable seed disinfectant must possess high adherence and such toxicity and solubility that the seed is surrounded at the critical moment of attack and even under irrigation conditions by a lethal film. In tests with numerous mercurial compounds the greatest toxicity was displayed by a solution of mercuric chloride and mercuric iodide previously mixed

in a ratio of 3 to 1, which inhibited the growth of the organism when used at a dilution of 1 in 2,000,000. The paper concludes with a series of tables showing the percentage of infection obtained with seed treated with numerous dusts and that obtained with untreated seed.

KONONENKO (E. V.). Лизис возбудителя вилта Хлопчатника **Verticillium dahliae,** вызываемый некоторыми миксобактериями. [Lysis of the causal organism of Cotton wilt, *Verticillium dahliae*, induced by certain myxobacteria.]—*Микробиол.* [*Microbiol.*], vi, 6, pp. 699–716, 3 pl., 1 graph, 1937. [English summary.]

Most of the soils examined in Armenia (U.S.S.R.) were found to contain myxobacteria (*Polyangium* and *Myxococcus* spp.) antagonistic to the agent of cotton wilt (*Verticillium dahliae*) [*R.A.M.*, xvii, p. 109], lysis of the mycelium of which was induced by contact with either small clots of infested soil or pure cultures of the organisms in question. This antagonistic relationship finds expression under natural conditions as well as in the laboratory, the bacteria being capable of hindering sclerotial development and destroying the young mycelium in the soil.

PETCH (T.). **Notes on entomogenous fungi.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 34–67, 1937.

In this further contribution to his studies on entomogenous fungi [*R.A.M.*, xiv, p. 443] the author gives notes on 34 species, among which the following are described (with Latin diagnoses) as new to science: *Entomophthora pyralidarum* on Pyralid moths attached to the trunks of various trees in Ceylon; *Hypocrella cornea* on an Aleyrodid on *Rubus* in the Kwangsi Province, China; *Cordyceps subsessilis* on larvae of Coleoptera in wood in North America; *C. erotyli*, with its conidial stage *Spicaria* (*Isaria*) *erotyli* n.sp., on *Erotylus* sp. (Coleoptera) in Trinidad; *C. ramosa* on Coleopterous larvae in Trinidad; *C. variabilis* on larvae of Coleoptera in North America; *C. cylindrica* on a trap-door spider in Trinidad; *C. elongata* on pupae and larvae of *Apatela americana* (Lepidoptera) in North America; *Hirsutella gigantea* on pupae of the same insect also in North America; *Calonectria hirsutellae* on a leaf-hopper in North Carolina; *Torrubiella paxillata* on the larva of a Chrysopid (Neuroptera), in North America; *Hirsutella dipterigena* (parasitized by *Stibella kervillei*) on the fly *Blepharoptera serrata* in Derbyshire; *Hymenostilbe ampullifera* on a Tipulid (*Dicranomyia pubipennis*); *H. fragilis* on Orthoptera in Trinidad, British Guiana, and Brazil; *Spicaria* (*I.*) *laxa* on Coleopterous larvae in North America; and *Aegerita insectorum* on the larvae of *Urophora solstitialis* (Diptera) at Cambridge, England. The fungus on spiders, which was referred in 1931 by Sartory, Sartory, and Meyer to the genus *Verticillium* [ibid., x, p. 663] is believed to be most probably the same as that described in 1892 by Cavara under the name *Sporotrichum aranearum*; in the author's opinion it is a species of *Acremonium*, for which the name *A. tenuipes* nom.nov. is suggested. The name *Empusa planchoniana* [Cornu] Thaxter is stated to be based on a mis-identification. Cornu's fungus is renamed *E. planchoniana* (Cornu) Petch, and Thaxter's fungus is named *E. thaxteriana* Petch nom.nov. [but see International Rules: ibid., xvi, p. 482].

TAKASU (R.). **Studien über die roten, pathogenen Hefen.** [Studies on the red pathogenic yeasts.]—*Jap. J. Derm. Urol.*, xlii, 4 (*Suppl.*), pp. 258–261, 1937.

An account is given of studies on ten red pathogenic yeasts, nine of which were obtained from Prof. Ota's collection while the tenth was isolated by the writer from a case of cystitis blastomycetica.

The results of animal inoculation experiments confirmed the pathogenicity of the following species only: *Torulopsis pararosea* (*Cryptococcus pararoseus*) Cast. [*R.A.M.*, xvi, p. 609], *T.* (*C.*) Cast. Re [? *C. castellanii*: ibid., v, p. 98], and *Candida* (*Myceloblastanon*) sp. (*Torula* II Urb. & Zach). The two organisms isolated by Yamamoto from cases of onychia (*Torulopsis* and *C.* (*M.*) spp.), though only mildly pathogenic to animals, may probably also be regarded as agents of the condition under observation.

A species of *T.* isolated by Ota and Masuda from a case of cystitis in 1930 forms cells measuring 5 to 7 by 3 to 5 μ, the corresponding dimensions for *T. pararosea*, *T.* Cast. Re, *T.* sp. (Honda B, the writer's above-mentioned isolation), and *T.* Urb. & Zach being, respectively, 2 to 5 or up to 10 μ in length, 2 to 3 μ in diameter, 3 to 5 μ in diameter, and 5 to 10 (occasionally 15 to 20) μ in length. None of these species formed a pseudomycelium.

In the case of Yamamoto's *Candida* the spherical cells measure 3 μ in diameter and the oval 5 to 7 by 2 to 5 μ, with occasional very long individuals (more than 20 μ). Rudimentary pseudomycelia are formed on carrot agar. This strain corresponds to Ota's *Mycelorhizodes*, a subgenus of *Myceloblastanon*. In *C.* (*M.*) Urb. & Zach the cells ordinarily measure 3 to 5 μ in diameter but may attain a length of 20 or 30 μ. This species, like the foregoing, produces conspicuous dendritic growth in type cultures but no pseudomycelium. These two species constitute transitional stages between *Torulopsis* and *Candida* and should provisionally be placed in the latter genus.

All the species investigated formed acid and gas from glucose, galactose, and maltose, and other sugars (except saccharose) were also more or less extensively utilized.

WOOD (MARTHA A.) & WELLENSIEK (ELLEN K.). **A species of fungus as an apparent pathogen in subacute or chronic inflammations of different organs of the body.**—*Tex. St. J. Med.*, xxxiii, 3, pp. 247–252, 4 figs., 1937.

Full clinical particulars are given of seven cases of subacute or chronic inflammations of various organs associated with the presence of large, spherical, yeast-like, thick-walled bodies, of the *Blastomyces* [*Blastomycoides*] type [*R.A.M.*, xv, p. 504], and small, refractile, spherical, motile bodies, frequently occurring in clusters. Inoculation experiments on rabbits gave positive results.

HALTY (M.) & CHARLONE (R.). **Un caso de esporotricosis. Consideraciones clinicas e histológicas.** [A case of sporotrichosis. Clinical and histological considerations.]—*Arch. urug. Med.*, x, 4, pp. 459–468, 4 figs., 1937.

Particulars are given of the condition brought about by the multiple

nodular abscesses developing as a sequel to an injury on the left hand of a 40-year-old man, the pus from which yielded a fungus identified by J. E. MacKinnon as *Sporotrichum beurmanni* [*R.A.M.*, xvii, p. 39].

MIENICKI (M.) & RYLL-NARDZEWSKI (C.). **Ein Fall von Sporotrichose der Haut und der Mundschleimhaut.** [A case of sporotrichosis of the skin and of the oral mucous membrane.]—*Przegl. derm.*, xxxii, pp. 62–69, 1937. [Polish, with French summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 1, pp. 68–69, 1938.]

Sporotrichum (?) *beurmanni* [see preceding abstract] was isolated on Sabouraud's agar from nodules on the right cheek and from the mucous membrane of the mouth of a young soldier and inoculated into rats with positive results. Sporotrichosis is stated to be of very rare occurrence in Poland. In the present case a decayed tooth is believed to have been the source of infection.

ARAKAWA (T.). **Über die sogenannte 'Schizosaccharomycosis Benedek'.** [On the so-called 'Schizosaccharomycosis Benedek'.]—*Hihu-to-Hitunyo, Hukuoka*, v, pp. 36–42, 1937. [Japanese, with German summary on pp. 3–4. Abs. in *Zbl. Haut- u. GeschlKr.*, lvi, 6, p. 410, 1937.]

Schizosaccharomyces hominis [= *Mycoderma hominis* (Ben.) Vuillemin: *R.A.M.*, ix, p. 244] was isolated in pure culture from two cases presenting extensive erythemato-squamous or -papulous foci. The organism was pathogenic to mice and rabbits. The systematic position of *S. hominis*—as yeast or bacterium—is left open [but an editorial note states that Benedek, in a recent personal communication, has referred it to the sporogenous bacteria].

RIVELLONI (G.). **Isolamento di un raro micete (Malbranchea bolognesii-chiurcoi) da una micosi umana.** [The isolation of a rare fungus (*Malbranchea bolognesii-chiurcoi*) from a human mycosis.]—*Boll. Sez. reg.* (*Suppl. G. ital. Derm. Sif.*), xvi, 3, p. 384, 1937.

Malbranchea bolognesii-chiurcoi [*R.A.M.*, vi, p. 483] was isolated on Sabouraud's agar from an erythematous-pustular lesion on the upper lip of a young man in Italy.

FRANCHI (F.). **Lesioni cutanee da Cephalosporium acremonium Corda. (Contributo clinico-sperimentale.)** [Cutaneous lesions due to *Cephalosporium acremonium*. (A clinico-experimental contribution.)] —*Dermosifilografo*, xii, pp. 301–326, 1937. [Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 1, p. 69, 1938.]

Cephalosporium acremonium [*R.A.M.*, xv, p. 580] was isolated at Turin from a 42-year-old peasant woman who had been suffering for three years from scattered chronic, gummatous skin nodules following injury to the leg. The fungus was inoculated into guinea-pigs and white rats which developed swellings similar to those observed in the human patient.

Gougerot (H.). **Pityriasis versicolor invisibles révélés par la leucomélanodermie solaire ponctuée.** [Invisible foci of pityriasis versicolor revealed by punctuated solar leucomelanodermia.]—*Arch. derm.-syph., Paris,* ix, 2, pp. 231–238, 1 fig., 1937.

Details are given of the symptoms and treatment of six cases in which pityriasis versicolor, associated with profuse infection by *Malassezia furfur* [*R.A.M.*, xvii, p. 38], developed as a sequel to sun-bathing.

Durham (O. C.). **Incidence of air-borne fungus spores. I. Alternaria.**—*J. Allergy,* viii, 5, pp. 480–490, 1 fig., 4 graphs, 1 map, 1937.

From the results of the exposure of some 2,000 vaseline-coated slides in 40 localities of the United States in 1936, supplemented by data from about 3,000 of the writer's slides exposed during 1933, 1934, and 1935, it was found that the average number of *Alternaria* spores per cu. yd. of air for a 24-hour period is considerably more than 25. Considering the size of the *A.* spore particles and their quantitative distribution, they may be assumed to be inhaled in amounts comparable to the pollen of ragweed [*Artemisia*] and to be similarly implicated in the etiology of asthma and hay-fever [*R.A.M.*, xvi, p. 533 and next abstract].

Prince (H. E.) & Morrow (Marie B.). **Molds in the etiology of asthma and hay fever with special reference to the coastal areas of Texas.**—*J. sth. med. Ass.*, xxx, 7, pp. 754–762, 2 figs., 3 graphs, 1 map, 1937.

Moulds, including *Monilia sitophila, M. geophila, Aspergillus niger* (group), *A. sydowi, A. japonicus*, and species of *Penicillium, Trichoderma, Hormodendrum, Helminthosporium*, and *Cladosporium*, are stated to be excessively prevalent (the number of spores per cu. yd. of air being estimated at 2,688 in 24 hours) in certain coastal regions of Texas, to which they are conveyed by north winds from the swampy interior. Encouraging results have been obtained by therapeutic injections with extracts of these organisms, and also of *Alternaria*, not recovered locally, into patients suffering from respiratory allergic disorders of the asthma and hay-fever type [cf. preceding abstract].

Davidson (A. M.) & Gregory (P. H.). **The spiral hyphae of Trichophyton.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 98–113, 15 figs., 1937.

As a result of their studies in Winnipeg, Manitoba, the authors are led to believe that the spiral hyphae [*R.A.M.*, xiii, p. 578] which develop in pure cultures of species of *Trichophyton*, and for the most part are not considered to possess any particular function, are in reality organs of attachment and play a part in the dissemination of the fungus. Observations on the development of these hyphae in cultures of *T. gypseum, T. interdigitale, T. asteroides, T. granulosum*, and *T. persicolor* showed that all the spirals were counter-clockwise; occasional clockwise spirals were, however, found in some isolates of *T. interdigitale.* When mature, the spirals are empty, dead hyphae, flattened in a plane at right angles to the axis of the spiral, and may

be branched. After deformation by mechanical contact the spirals regain their original shape, a process which is probably aided by the flattening of the hyphae. Further observations indicated that the mycelium of *T. gypseum* is sticky, and tends to adhere to objects coming into contact with it, a property which is not shared by *Microsporon felineum*. In the authors' opinion, the function of the spirals is to present a large adhesive surface, and thus to ensure that a relatively large inoculum becomes attached to an animal coming into contact with the saprophytic mycelium.

In an appendix to this paper a method is briefly described for determining the spiral structure of microscopic objects by differential focussing.

KAMMER (A. G.) & CALLAHAN (R. H.). **Torch oil dermatitis: its relation to epidermomycosis ('ringworm').**—*J. Amer. med. Ass.*, cix, 19, pp. 1511–1517, 2 figs., 1937.

Torch oil dermatitis, an eruption of the hands of machinists in steel mills, appears from a study of 30 cases to be correlated with the existence of a focus of interdigital epidermomycosis [*Trichophyton interdigitale*: *R.A.M.*, xvii, p. 176] of the feet.

MILOVANOVICH (M.). **Favus bei einem Neugeborenen.** [Favus in a new-born infant.]—*Med. Rev., Belgrade*, xii, p. 65, 1937. [Serbo-Croatian, with French summary. Abs. in *Zbl. Bakt.*, Abt. 1 (Ref.), cxxvii, 23–24, pp. 526–527, 1937.]

The infant of a mother affected for 20 years by favus developed facial symptoms of the disorder four days after birth. In both mother and child the clinical features and microscopic observations pointed to *Trichophyton faviforme album* [*T. album*: *R.A.M.*, xvi, pp. 316, 810], the sole known agent of the disease in Yugoslavia, and this fungus was subsequently isolated in pure culture. Guinea-pigs inoculated with cultures from the mother developed favus in a week and *T. album* was recovered from the lesions.

MILOVANOVICH (M.). **Doppelte Infektion mit Dermatophyten.** [Double infection with dermatophytes.]—*Med. Rev., Belgrade*, xii, pp. 15–16, 1937. [Serbo-Croatian, with French summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 2, pp. 130, 1938.]

An account is given of four cases in which the same patient was infected by two distinct dermatophytes—*Trichophyton album* [see preceding abstract] and *T. violaceum*, the latter also occurring in the company of *Microsporon audouini*. These three fungi are stated to be the most common agents of human and animal dermatomycoses in Yugoslavia, where their development is favoured by the prevailing low standards of hygiene.

KOZLOVA (Mme R. F.) & LAVRENTIEVA (Mme L. I.). **Erreger der Pilzerkrankungen in Kirgisien.** [The agents of fungal diseases in Kirghizia.]—*Vyestn. venerol. derm.*, iii, pp. 289–294, 1937. [Russian. Abs. in *Zbl. Haut- u. GeschlKr.*, lvii, 5–6, p. 465, 1937.]

Men are stated to be much more liable than women to favus in

Kirghizia (U.S.S.R.), whereas trichophytosis affects both sexes indiscriminately. *Achorion schoenleini* was isolated in 40·9 per cent. of the cases examined and *Trichophyton violaceum* [*R.A.M.*, xiii, pp. 96, 511, and preceding abstract] in 43·1.

MINAMI (S.) & HIGUTI (K.). **Ein Fall von tinea imbricata.** [A case of tinea imbricata.]—*Hihu-to-Hitunyo, Hukuoka*, v, pp. 431–437, 9 figs., 1937. [Japanese. Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 1, p. 68, 1938.]

Endodermophyton tropicale or *E. indicum* [*Trichophyton indicum*], collectively known as *E.* [*T.*] *concentricum* [*R.A.M.*, xvi, p. 457], was isolated at Hukuoka from the infected sites in a Philippine woman suffering from tinea imbricata and inoculated into a human patient with positive results in the form of mycelium in the squamae, as in the original instance. In Japan the disease is not prevalent, having been reported only from Formosa, Manchukuo, and the tropical islands.

MUENDE (I.) & WEBB (P.). **Ringworm fungus growing as a saprophyte under natural conditions.**—*Arch. Derm. Syph., Chicago*, xxxvi, 5, pp. 987–990, 2 figs., 1937.

In April, 1936, the writers visited a farm near Oxford, England, to investigate a severe outbreak of ringworm among calves kept in stone-walled sheds with wooden partitions and feeding-troughs. Cultures obtained from the hair and scales of the animals was identified as *T. gypseum asteroides* [*T. mentagrophytes*: *R.A.M.*, xvii, pp. 38]. Three months later a comprehensive collection of fungi was made in the same sheds, and one of the 47 specimens collected was identical with that obtained from the calves. Experimental inoculations showed it to be pathogenic to guinea-pigs. Fourteen healthy calves confined in the sheds during the following October also contracted the disease. This is believed to be the first record of a ringworm fungus growing as a saprophyte in nature.

SANBORN (J. R.). **Microbiological control in the manufacture of paper wraps and containers for foods.**—*Industr. Engng Chem.*, xxix, 8, pp. 949–951, 3 graphs, 1937.

Among the micro-organisms liable to occur as contaminants in mills engaged in the manufacture of paper and board for food wrappers and containers may be mentioned *Oidium* [*Oospora*] *lactis* [*R.A.M.*, xvi, p. 198], *O.* [*Pullularia*] *pullulans*, *Aspergillus fumigatus*, *Monilia candida* [*Candida vulgaris*], *Trichoderma lignorum*, *Mucor racemosus*, *Botrytis cinerea*, *Cladosporium herbarum*, and *Penicillium guttulosum*. Control should be based on chlorination of the process water, supplemented if necessary by dripping in copper sulphate solution at focal points in the system, and on the immediate encasing and sealing of wrapper and container stock to avoid exposure to infection. Direct human contact should be reduced to a minimum, and in fact, detailed studies of the micro-organisms present in paper containers for milk indicate the necessity for adopting hygienic procedures at every step in their fabrication in order to reach the requisite grade of cleanliness.

Cook (W. R. I.) & Collins (W. B.). **A Pythium wilt of Primula caused by Pythium spinosum Sawada.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 29–33, 7 figs., 1937.

A serious outbreak of wilt of *Primula sinensis* seedlings in the seed pans occurred at the John Innes Horticultural Institution in 1934, and was found to be associated with the presence of *Pythium spinosum* [cf. *R.A.M.*, xi, p. 330], which was isolated consistently from infected material. The soil used, however, had been sterilized for 40 min. at 100° C. and then had been left exposed in a soil bin for six weeks before it was used for potting the seedlings. [No infection experiments with the fungus are described.]

Moore (W. C.) & Buddin (W.). **A new disease of Tulip caused by species of Pythium.**—*Ann. appl. Biol.*, xxiv, 4, pp. 752–761, 1 pl., 1937.

An account is given of the authors' studies of a disease of tulips, isolated outbreaks of which have been reported since the end of 1934 from Lincolnshire, Northamptonshire, Yorkshire, and Middlesex, and which is mainly characterized by a root rot, and dwarfing and lack of vigour in the plants, sometimes accompanied, however, by a partial or complete destruction of the bulbs and bases of the flowering shoots. Isolations from diseased material yielded a species of *Pythium*, which was shown in pure culture to be nearly related to, though not identical with, *P. de Baryanum* var. *pelargonii* [*R.A.M.*, xvi, p. 814]. A culture isolated from diseased tulip bulbs in Holland and another one from tulips affected with zonal rot in Denmark [ibid., xiv, p. 559] were both identified as *P. ultimum*. Inoculation experiments with William Copland tulips indicated that under special conditions of soil or environment, not yet clearly understood but probably involving a relatively high temperature and a moisture factor, both the English and the continental organisms are capable of attacking tulip bulbs, and that the disease may be contracted from the soil or carried with the bulbs. It is believed that the trouble may be easily controlled by examining the tulip bulbs as soon as they are received, and by discarding all the rotting ones; the rest should be stored in trays in a dry and not too warm atmosphere; forcing should be done in suitable, previously sterilized soil.

Blumer (S.). **Untersuchungen über die Biologie von Ustilago violacea (Pers.) Fuck. I. Mitteilung: Ernährungs- und Kulturbedingungen. Wirkungen des Saponins.** [Studies on the biology of *Ustilago violacea* (Pers.) Fuck. Note I: Nutritional and cultural requirements. Effects of saponin.]—*Arch. Mikrobiol.*, viii, 4, pp. 458–478, 6 graphs, 1937.

Full particulars are given of the writer's cultural experiments at the Botanical Institute of Berne University with *Ustilago violacea* [*R.A.M.*, xvi, pp. 180, 726] f. *melandrii-rubri*, a few supplementary tests also being carried out with ff. *silenes-nutantis* and *dianthi-deltoidis*, all procured from the Bureau voor Schimmelcultures, Baarn.

The medium used consisted of 0·15 per cent. each of asparagin and potassium dihydrogen phosphate, 0·05 per cent. magnesium sulphate,

and a carbohydrate. No carbohydrate induced satisfactory growth without the addition of saponin (commercial brands) at concentrations up to 5 per cent., in the presence of which, however, arabinose, sorbite, mannite, levulose, glucose, mannose, saccharose, maltose, and salicin served as valuable sources of carbon. The stimulatory effect of saponin was found to be due to the admixture of an accessory substance (identified after the paper was sent to press as the growth hormone aneurin) [ibid., xvii, p. 196].

SCHOPFER (W. H.). **Über die Einwirkung von Aneurin auf das Wachstum von Ustilago violacea.** [On the influence of aneurin on the growth of *Ustilago violacea.*]—*Ber. dtsch. bot. Ges.*, lv, 9, pp. 572–576, 1 graph, 1937.

Following up Blumer's studies on the beneficial influence of aneurin (the vital principle of saponin) on the development of cultures of *Ustilago violacea* on a synthetic medium [see preceding abstract], the writer ascertained the optimum dose of the growth hormone for this purpose to be 0·006 γ per 25 c.c. of nutrient solution. As in the case of *Phycomyces* and *Staphylococcus*, the aneurin molecule as a whole may be replaced by a mixture of its two components, 2-methyl-4-amino-5-amino-methyl-pyrimidin and 4-methyl-5(β-oxyethyl)-thiazol, without loss of growth-promoting efficacy.

STORCK (A.). **Die wirtschaftliche Bedeutung der Sommeraster (Callistephus chinensis Nees) für den deutschen Gartenbau und die Ueberwindung der Anbaukrise durch die Züchtung welkeresistenter Rassen.** [The economic importance of the China Aster (*Callistephus chinensis* Nees) in German horticulture and the breeding of wilt-resistant strains as a means of overcoming the crisis in its cultivation.]—*Landw. Jb.*, lxxxv, 1, pp. 83–163, 16 figs., 2 diags., 6 graphs, 1937.

This is an exhaustive, fully tabulated, and copiously documented account of China aster (*Callistephus chinensis*) cultivation in Germany, with special reference to the economic importance of this favourite annual, and to the possibilities of breeding for resistance as a means of combating the wilt disease (caused chiefly by *Fusarium oxysporum* f. 6 [*R.A.M.*, xiv, p. 447], occasionally associated with *F. conglutinans* var. *callistephi* [ibid., xvi, pp. 753, 812]), which seriously threatens the commercial production of the crop.

C. chinensis is cultivated both for seed and market purposes, the plantings for the former object (mainly located in Saxony and Thuringia) covering about 100 hect. with an estimated yield value of Rm. 180,000 to 250,000, while those for the latter extend over some 1,500 to 1,650 hect. The crop being largely grown by smallholders without adequate facilities for the execution of the soil disinfection operations essential to the control of the pathogens, the systematic development of wilt-resistant varieties assumes considerable urgency. In experiments carried out from 1934 to 1936 the inherently powerful resistance of the American strains (some 130 of which were tested) was found in most cases to undergo appreciable diminution as a result of continuous cultivation in Germany: this is attributed to the practice,

which should immediately be rectified, of raising seed crops on fresh sites instead of on old, infested soil where the accumulated virulence of the pathogens calls forth the natural resistance of the plants. Among the commercial varieties wilt-resistant strains were found only in three classes, viz., very tall, represented by American Bush and Beauty, tall (Giant Comet and Ostrich Feather), and medium (Halls), leaving an immensely wide scope for further breeding activity. It was further shown by these experiments that *F. oxysporum* f. 6 is of negligible importance in German seed-beds, while appreciable damage by *Verticillium albo-atrum* [ibid., xiv, p. 447] is of rare occurrence.

WENZL (H.). **Botrytis cinerea als Erreger einer Fleckenkrankheit der Knospen und Blüten der Rose ('Blütenfeuer').** [*Botrytis cinerea* as the agent of a spot disease of Rose buds and petals ('petal fire').]—*Gartenbauwiss.*, xi, 4, pp. 462–472, 3 figs., 1938.

Following very changeable weather during the latter half of July and exceptionally heavy rainfall on the first few days of August, 1936, a severe epidemic of *Botrytis cinerea* broke out in an extensive Lower Austrian rose nursery [*R.A.M.*, xiv, pp. 313, 363], where the plants not only suffered from the familiar brown rot of the buds, flowers, bud stalks, and leaves, but also showed a necrotic spotting of the petals, dark red and zonate on white, pink, or orange varieties, colourless and water-soaked on dark red ones, while on pure yellow the red margin was not invariably present. The lesions, mostly 2 to 3 or up to 5 mm. in diameter, were frequently so densely aggregated as to coalesce in the later stages. Infection usually took place on the closed buds but sometimes on the fully open flower; on one variety (Mrs. Pierre de Pont) the petals were occasionally irregularly crinkled.

Inoculation experiments on cut roses in the greenhouse resulted in the same symptoms as were observed in the open. None of the 140 varieties inspected proved to be entirely resistant to the fungus, though not all manifested the unusual floral spotting herein described. Only mild symptoms, however, were exhibited by Nigrette, Rev. F. Page Roberts, Roslyn, Talisman, and Ville de Paris.

WIJERS (EVERDINA E.). **Phytophthora wilt in Carnation plants.**—*S. Afr. J. Sci.*, xxxiv, pp. 194–213, 3 figs., 1937.

This is an account of a serious wilt of carnations, which is stated to have been prevalent in Pretoria since 1935, and specimens of which were also received from nurseries in four other localities in South Africa. The condition is characterized by a rapid and complete wilting of the plants within 24 to 48 hours, a light greenish-grey discoloration of the leaves, and a rot of the lateral roots. The tissues of the crown and stem base have a brown, water-soaked appearance. Isolations from diseased tissues [by a technique which is briefly described] yielded pure cultures of a species of *Phytophthora*, four strains of which, originating from carnation plants of different ages, were compared with two strains isolated from wilted sweet sultan (*Centaurea*) and *Verbena* plants, respectively, and with *P. cactorum* from snapdragon (*Antirrhinum majus*) [*R.A.M.*, xiv, p. 238]; although these seven strains showed considerable variation, even within themselves, in the size and pro-

duction of sporangia, the production of oogonia, and in their growth and temperature relations, the author considers that all belong to the *P. cactorum* group; all were shown in inoculation experiments to be capable of attacking carnations, and all also caused rotting of tomatoes, potatoes, apples (one strain being very weakly pathogenic), and grapefruits. Mycelium of a species of *Fusarium* was also found in wilted carnations [ibid., xvii, p. 182], but soil inoculations with seven species of the same genus, obtained from the Centralbureau voor Schimmelcultures, Baarn, all described in relation to carnation wilt, gave negative results after six months. A species of *Rhizoctonia*, which was occasionally isolated from wilted carnations, when inoculated into the soil was shown to be capable of causing stem rot in this host.

CANNON (O. S.). **A Botrytis disease of the Dahlia and its relation to Botrytis diseases of other plants.**—*Proc. Utah Acad. Sci.*, xiv, pp. 41–43, 1937.

Dahlia roots attacked by a *Botrytis* of the *cinerea* type [*R.A.M.*, xv, p. 370] were received at the Utah State College and inoculation experiments with the fungus showed it to be capable of attacking all parts of the dahlia. The fungus is closely related to forms of *Botrytis* causing diseases of other plants. Control measures recommended are field sanitation, proper spacing of the plants, and storage in a cool, fairly dry atmosphere.

OSBORN (H. T.). **Vein-mosaic virus of Red Clover.**—*Phytopathology*, xxvii, 11, pp. 1051–1058, 3 figs., 1937.

Vein mosaic virus of red clover (*Trifolium pratense*) was originally obtained from naturally infected plants in New Jersey, which were found by repeated passage to seedlings by means of the pea aphid [*Macrosiphum pisi*] to be infected with more than one virus. Some plants showed the mottling associated with pea virus 2 [*R.A.M.*, xvi, p. 722], while others exhibited a yellow coloration along the veins, sometimes accompanied by small, yellow spots in the interveinal areas. Successive passages to healthy clover plants resulted in the isolation of a virus that produced only vein mosaic symptoms.

The following plants were infected by the red clover vein mosaic virus, using *M. pisi* as a vector: broad bean (*Vicia faba*), Olympia sweet pea, red clover, white clover (*T. repens*), alsike (*T. hybridum*), and crimson clover (*T. incarnatum*). The virus was also transmitted mechanically (by leaf-rubbing) from red clover to *V. faba* and from *V. faba* to red, white, alsike, and crimson clovers, white sweet clover (*Melilotus alba*), Canada white field pea, and Alderman, Telephone, Perfection, and Horal garden peas. The usual incubation periods of the disease in red clover, *V. faba*, and peas are three to four weeks (but may be 14 days or as long as six weeks), 14 to 21 days, and 12 to 14 days, respectively. In *V. faba* infection assumes the forms of local necrotic splotches and rings, vein-clearing, tissue distortion on the under leaf surfaces giving the appearance of whitish bands along the veins, a purplish discoloration of the stalk surfaces, severe stunting, and clump production at the stem bases. Peas also show vein-clearing, rosetting of the apical leaves, and rapid wilting, the plants frequently

being dead three weeks after inoculation. The few sweet peas infected showed comparable symptoms.

The specific vein mosaic virus was found to be active (as determined by mechanical inoculations on *V. faba*) after ten minutes' heating at 58° C., but not after the same period at 60°, and it resisted two but not three days' ageing.

No incubation period of the virus was observed in colonies of *M. pisi* fed on diseased plants and then transferred to a succession of healthy ones for a total period of 14 days. The pea aphid was found to acquire and transmit the virus within a period of two hours, and to lose it during a single day's feeding on healthy plants.

CORMACK (M. W.). **Fusarium spp. as root parasites of Alfalfa and Sweet Clover in Alberta.**—*Canad. J. Res.*, Sect. C, xv, 11, pp. 493–510, 1 pl., 1 fig., 1 graph, 1937.

This is a study of five predominant species of *Fusarium*, viz., *F. avenaceum*, *F. arthrosporioides*, *F. culmorum*, *F. poae*, and *F. scirpi* var. *acuminatum*, which cause the root rots of lucerne (*Medicago falcata*, *M. sativa*, and *M. media*) and sweet clover (*Melilotus alba* and *M. officinalis*) in Alberta. The two first-mentioned species appear to be the most important since they occur commonly and cause serious injury to the roots both in the early spring and during the growing season. *F. culmorum* attacks the roots only during the summer, when it causes rapid death of the plants. *F. poae* and *F. scirpi* var. *acuminatum* are comparatively weak pathogens. *F. arthrosporioides*, *F. culmorum*, and *F. poae* are new records on both hosts, as is *F. scirpi* var. *acuminatum* on sweet clover.

The amount of infection with the *F.* spp. was found to be correlated with the soil temperature, especially in the case of *F. culmorum*, two isolates of which were highly pathogenic in July, when the soil temperature averaged 20° C., but caused only slight infection in September, when the soil temperature averaged 12°. Both *F. avenaceum* and *F. arthrosporioides* caused approximately the same degree of injury in September as in July. Both species grew well in pure culture at a wide range of temperature, with a minimum of −2°, an optimum at about 24°, and a maximum at 34°, whereas *F. culmorum* required a higher temperature and showed a minimum of 3°, an optimum at 24° to 27°, and a maximum at 34° to 36°, making only very slow growth at temperatures below 10°. The cardinal temperatures for *F. poae* and *F. scirpi* var. *acuminatum* were −2°, 20° to 24°, and 32°, and 1°, 24°, and 34°, respectively. All five species grew well at hydrogen-ion concentrations ranging from P_H 4·0 to 9·5, particularly in the alkaline range. Carbon dioxide concentrations up to 20 per cent. did not appreciably influence the growth of *F. avenaceum*, *F. arthrosporioides*, or *F. poae*, but concentrations of 15 to 20 per cent. had a retarding effect on *F. culmorum* and *F. scirpi* var. *acuminatum*, which was greater at a temperature of 8° than at room temperature.

F. avenaceum easily penetrated the roots through the basal tissue of branch roots and through lenticels, and readily invaded the central portions of the tap-root, causing a rapid rotting. The hyphae proceeded singly or aggregated into strand-like masses which forced their way

through the tissues, the fungus apparently exerting a toxic action some distance beyond the infected area.

In field infection experiments isolates of *F. avenaceum* obtained from oats and barley caused moderate and light infection, respectively, on roots of sweet clover, but were only slightly pathogenic to lucerne. An isolate from wheat was non-pathogenic. Isolates of *F. culmorum* from wheat were almost as virulent as one from sweet clover. On the other hand, in greenhouse tests strains of *F. avenaceum*, *F. culmorum*, and *F. arthrosporioides* isolated from lucerne or sweet clover caused heavy infection of wheat and light to heavy infection of barley and oats. Another experiment showed that three variants of *F. avenaceum* were decidedly less virulent than the original isolation from sweet clover.

SAMPSON (KATHLEEN). **Further observations on the systemic infection of Lolium.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 84–97, 2 pl., 20 figs., 1937.

Continuing her studies on the endophytic fungus of *Lolium* spp. [*R.A.M.*, xiv, p. 700; xvi, p. 616], the author states that in 1929 a second endophytic fungus was found to be present in a parent (No. 1972) selected in that year from a pedigree culture of *L. perenne*, which was first noticed by the fact that its mycelium in scrapings from the pith of the host was very faintly stained with cotton blue (owing to the presence of large vacuoles and sparse cytoplasm), in contrast to the richly coloured mycelium in a stained mount of the first endophyte. Experiments from 1930 to 1935, inclusive, showed that, like the first, the second endophyte is transmitted by vegetative propagation of the host, and also by the seed, the chief points of difference between the two, apart from mycelial characteristics, being that the second does not form a thick zone of mycelium in the fruit, and that it grows readily on all kinds of media, whereas cultures believed to represent the first endophyte could only be obtained on coagulated egg disks. In pure culture the second endophyte produces a rather compact, fluffy, funiculose, aerial mycelium, white to cream in colour, the submerged mycelium often discolouring the substratum chrome-yellow. In addition, and especially on natural media such as potato, rice, and wheat grains, it produces rather numerous spirally coiled hyphae somewhat resembling those observed in certain dermatophytes [see above, p. 243], and abundant hyaline, oval microconidia, measuring 2 to 2·5 by 1·5 μ. Since no other types of spores and no sclerotia have been seen either in pure culture or in nature, it was not possible to determine the taxonomic position of this organism, which can only be designated for the present as the second endophytic fungus of *L. perenne*.

After isolation on coagulated egg the first endophyte grew in agar media, on which it has so far always remained sterile, thus giving no clue to its identity.

RICHARDS (B. L.). **Susceptibility of Alfalfa varieties to bacterial stem blight.**—*Proc. Utah Acad. Sci.*, xiv, pp. 33–38, 2 graphs, 1937.

Continuing his studies on varietal resistance of lucerne to bacterial stem blight [*Bacterium medicaginis*: *R.A.M.*, xiii, p. 774], the author found that Ladak again proved the most resistant variety (0·87 per

cent. coefficient of susceptibility) in experiments carried out in 1935, followed by Cuban (1·36), Cossack 10643 (1·37), French 19272 (1·88), Grimm Utah (1·96), Grimm Lat. 496 (1·99), and Grimm Sask. 666 (2·07). The most susceptible were French 19274 (3·87), Turkestan 15754 (3·77), and South Africa 14203 (3·75). Hardigan 18999, which compared favourably with Ladak in 1933, was more susceptible (2·21) in 1935. While Ladak exhibits resistance to both stem blight and wilt [*Aplanobacter insidiosum*: ibid., xvi, p. 559], Turkestan, the most resistant variety to wilt, is the most susceptible to stem blight. Grimm varieties are highly susceptible to wilt but considerably resistant to stem blight. The severity of stem blight in both 1933 and 1935 was definitely correlated with frost injury.

PAPE (H.). **Beiträge zur Biologie und Bekämpfung des Kleekrebses (Sclerotinia trifoliorum Erikss.).** [Contributions to the biology and control of Clover stem rot (*Sclerotinia trifoliorum* Erikss.).]—*Arb. biol. Anst. (Reichsanst.) Berl.*, xxii, 2, pp. 159–247, 15 figs., 1 graph, 1937.

An exhaustive, fully tabulated account is given of the writer's studies on the biology and control of *Sclerotinia trifoliorum*, the causal organism of clover stem rot [*R.A.M.*, xvii, p. 185]. The fungus was found to develop profusely on such sugar- or starch-containing media as soaked cereal grains, bread (on which giant sclerotia were formed), and maltyl meat extract agar. Ammonium salts and asparagin promoted mycelial growth, the former also stimulating the formation of large sclerotia; urea suppressed sclerotial production, while glycocol favoured the development of numerous minute sclerotia. The optimum galactose and dextrose concentration for sclerotial production was 5 per cent. *S. trifoliorum* was found to tolerate a wide range of hydrogen-ion concentrations but grew best on the acid side of the scale (round about P_H 5·5), the minimum, optimum, and maximum temperatures for its development being 0°, 15° to 20°, and near 33° C. Exposure to an atmosphere containing up to 5 per cent. carbon dioxide seemed rather to augment than to depress the growth of the fungus.

Appreciable differences, especially in respect of growth rate and habit, between the 36 strains of *S. trifoliorum* are considered to point to the existence of physiologic races within the fungus, and this was confirmed by inoculation experiments.

The mycelium and ascospores of the stem rot organism, when kept in a dry state, remained viable for rather more than seven months; sclerotia buried in the soil mostly lived for 7½ years, but only some of those kept dry in the laboratory survived for 4½ years. Viable sclerotia of *S. trifoliorum* were found in commercial samples of red, white, and crimson clovers (*Trifolium pratense*, *T. repens*, and *T. incarnatum*), *Medicago lupulina*, lucerne, *Anthyllis vulneraria*, and white sweet clover (*Melilotus alba*). In the case of mature plants the sclerotia were found exclusively on the stems, sometimes at a height of 20 to 40 cm., a fact that explains their presence in harvested material and transmission to the seed during threshing operations. The perpetuation of *S. trifoliorum* by means of the mycelium and ascospores is regarded as dubious. The sclerotia may be readily eliminated from clover seed by dusting the

sample with iron powder, which adheres only to the sclerotia, which are then removed by means of a powerful electro-magnet. In the case of large-seeded clovers, such as *T. incarnatum* and *T. pratense*, the sample may be shaken into a 23 to 24 per cent. potassium chloride solution, in which the sclerotia and defective seeds float while the good seed sinks. None of the standard fungicides tested was destructive to the sclerotia of *S. trifoliorum* except at high concentrations and acting for lengthy periods, under which conditions the germinability of the clover seed was impaired. It was, however, possible so to weaken the sclerotia that they were unable to form apothecia by 30 minutes' immersion of red, white, or crimson clover seed in 0·1 per cent. mercuric chloride (or 15 minutes' at 0·5 per cent. for the two first-named). The ascospores of the fungus succumbed to 15 minutes' immersion in 0·25 per cent. germisan or uspulun.

According to information based on a study of the relevant literature, supplemented by five years of practical observation in the field in Schleswig-Holstein, the writer concludes that *T. pratense*, *Medicago lupulina*, *T. incarnatum*, and *A. vulneraria* are highly susceptible to stem rot, *Onobrychis sativa*, *Melilotus alba*, and lucerne moderately so, and *T. hybridum*, *Lotus corniculatus*, and *T. repens* resistant. Under local conditions foreign strains from comparatively warm regions proved to be more susceptible than home-grown clover or that imported from districts with a fairly cold climate, while early ripening strains tended to be more severely attacked than late ones.

A case of stem rot was actually observed in *Vicia sepium* and the pathogenicity of *S. trifoliorum* to winter peas is suspected. *V. sativa* was attacked by the fungus in an inoculation test, and in one case the passage of the mycelium from crimson clover to the leaves of adjacent winter rape plants was detected. The following weeds (all new hosts for *S. trifoliorum*) were found harbouring the fungus in the course of field inspections in Schleswig-Holstein: *Erodium cicutarium*, *Taraxacum officinale*, *Holosteum umbellatum*, *Scleranthus perennis*, *Melandryum album*, and *Silene nutans*. The strain of the fungus from *E. cicutarium* was pathogenic in inoculation experiments on *Trifolium pratense*, *T. hybridum*, and *Medicago lupulina*, while that from *Taraxacum officinale* attacked *Trifolium incarnatum* in addition to the foregoing.

A considerable reduction in the incidence of stem rot may be effected by mowing the clover in the autumn, followed by rolling and grazing by livestock, the last-named measure being particularly helpful. Further directions are given for combating *S. trifoliorum* along the lines indicated by these investigations.

SMITH (C. O.). **Inoculation of some economic plants with Phytophthora cactorum and P. citrophthora.**—*Phytopathology*, xxvii, 11, pp. 1106–1109, 1 fig., 1937.

Among the more susceptible of some 50 economic plants whose woody stems were inoculated with the mycelium from pure cultures of *Phytophthora cactorum* and *P. citrophthora* on potato glucose agar were walnut (especially *Juglans californica*, *J. hindsii*, *J. regia*, and *J. nigra*, *P. cactorum* being the more virulent) [*R.A.M.*, xi, p. 339] and twelve Rosaceae, including cherry (*Prunus avium*), apricot, *P. mume*, peach,

pear, and apple. Other plants contracting an appreciable degree of infection were *Cedrus deodara*, *Castanea* sp., *Ceratonia siliqua*, ash, avocado, *Eucalyptus* sp., and an evergreen elm.

FRIEDRICH (G.). **Eine einfache Kontrolle des Fusicladium Sporenfluges (Venturia inaequalis [Cooke] Aderhold).** [A simple method of following the spore discharge of *Fusicladium* (*Venturia inaequalis* [Cooke] Aderhold).]—*Gartenbauwiss.*, xi, 4, pp. 457–461, 2 figs., 1 graph, 1938.

The apparatus devised by the writer for following the spring discharge of the apple scab (*Venturia inaequalis*) ascospores [*R.A.M.*, xvi, p. 469] in the vicinity of Hamburg consisted of a wooden air-tight chamber fitted with five spore traps in the form of vaselined cover slips which are impinged upon in turn by the air admitted through an apical funnel. The apparatus [which is described in detail] was fixed to the branch of a tree in the middle of a large stand of Beauty of Boskoops at a height of 1·5 m. and attached by a pressure tube to a motor suction pump absorbing 15 l. air per minute. The microscopic examination of the slips at the end of an hour showed that the bulk of the ascospores adhered to the top one, from which alone, in general, spore counts need be made.

Using this contrivance in 1937, the writer found that the ascospore discharge began on 15th April and reached a climax with a heavy shower of rain on 21st, following a few warm, dry days. The next outbreak occurred on the morning of 5th May, when after a heavy thunder shower 120 spores were trapped on the first slip from 900 l. of air (one hour's suction). By the evening of the same day the spores had been largely eliminated from the atmosphere by the heavy rainfall, only 15 being trapped in an hour. A temporary rise the next day to 40 per hour was rapidly succeeded by a substantial decline, the few spores trapped during the rest of the month being just the remnants of the main discharge.

Under local conditions in the Altenland, therefore, the period during which the apple trees required fungicidal treatment against infection by scab ascospores was relatively short, and one or two applications would have sufficed for control. The practical importance of the spore-catching method herein described lies in the rapidity with which the spores are trapped during the abundant discharge foretelling an epidemic outbreak, and the consequent saving of time in the initiation of preventive spraying operations.

DAVIS (M. B.). **Fertilizer problems and physiological disorders in Ontario.**—*Rep. pomol. Soc. Quebec, 1936*, pp. 34–39, 1937.

A somewhat alarming increase of physiological disorders of apples has been observed in Ontario during recent years, sometimes caused by wrong fertilizer practice or by soil difficulties amenable to correction. Leaf scorch [*R.A.M.*, xv, p. 587] is one of the most common foliage troubles, and occasionally may be due to waterlogged conditions of the soil leading to the destruction of the lower root system and resulting in reduction of potassium absorption, which takes place largely from the lower layers. The disease, if allowed to develop unchecked, finally

results in die-back of the affected trees. Another disorder characterized by the bronzing of the leaf, sometimes accompanied by purple coloration, is attributed to deficiency in phosphorus. The increasing prevalence of internal cork [ibid., xvi, p. 819] was studied and it was observed to develop more in dry years than in wet years. Bitter pit is prevalent in soils high in nitrogen where the trees show excessive vigour or leaf scorch symptoms are common. Inactivation of iron by high lime content of the soil and of manganese by a similar cause, or perhaps actual manganese deficiency, have each resulted in a few cases of chlorosis.

Donen (I.). **Studies in deciduous fruit. V. Preliminary observations on the relationship between nitrogenous metabolism and internal breakdown of Kelsey Plums in cold store.**—*Trans. roy. Soc. S. Afr.*, xxv, 1, pp. 83–102, 4 graphs, 1937.

A tabulated account is given of experiments in 1936 in Cape Town to determine the extent to which changes in the nitrogenous fractions in Kelsey plums (*Prunus salicina*) are related to the occurrence of internal breakdown during cold storage [*R.A.M.*, xiv, p. 321; xvi, p. 620]. The results showed that rapid hydrolysis of proteins takes place in both immature and ripe plums under all storage conditions, the path of protein breakdown being protein nitrogen → 'rest' nitrogen (representing all soluble nitrogenous compounds of higher complexity than amino acids or asparagine) → amino nitrogen. The more important conclusions drawn from the work are that under conditions of advanced maturity and high storage temperature, nitrogenous changes in the plums tend towards the accumulation of amino acids, whilst asparagin breaks down to amino acids and ammonia; low temperature, on the other hand, prevents asparagin breakdown, and immaturity inhibits amino acid nitrogen accumulation. Storage studies indicated that internal breakdown is almost entirely confined to immature fruit, and was most pronounced at 35° F.; it was not observed in plums kept at either 50° or 70°. These results suggested that conditions of maturity and storage which interfere with the course of progressive breakdown of nitrogenous compounds are also those which interfere with the normal ripening of the fruit and favour internal breakdown. Chemical analysis of browned and non-browned portions of the flesh of the plums indicated that the total nitrogen is not evenly distributed; it is higher in the browned portion, the major portion of the difference being made up of asparagin and 'rest' nitrogen. The fact that this gradient, which was shown not to be due to differential evaporation of water from the outer and inner portions of the fruit, gradually changes its direction as the browning of the flesh slowly spreads outwards, strongly suggests that the phenomenon is intimately connected with the mechanism of internal breakdown. It was also observed that browning is accompanied by a swelling and final bursting of the cells. This explains why cavities develop in the flesh in advanced stages of browning.

Hurt (R. H.). **1. The control of Peach leaf curl, scab and brown rot. 2. Spray materials for Peaches.**—*Bull. Va Truck Exp. Sta.* 312, 16 pp., 1 fig., 1937.

Peach leaf curl [*Taphrina deformans*] may be controlled under

Virginian conditions by the application, according to local schedules, of 4–4–100 (or stronger) Bordeaux mixture, beginning at the dormant season, lime-sulphur (6 gals. in 94 of water), or coal tar oil sprays at the rate of $2\frac{1}{2}$ gals. in 100, the last-named, however, not being generally recommended on account of their causticity to the foliage, and of expense. Sulphur treatments are also effective against scab [*Cladosporium carpophilum*: *R.A.M.*, xvi, p. 474], the first being given during the latter part of May. The blossom-blight phase of brown rot [*Sclerotinia fructicola*: loc. cit.] is uncommon but occasionally causes some damage in Virginia, the J. H. Hale and Red Bird varieties being the most susceptible. Lime-sulphur (6 to 8 qts. per 100 gals.) or one of the wettable sulphurs (summer strength) should be applied as the pink colour begins to show in the buds, a second treatment being given between 15th and 25th May, another during the latter part of June, and a fourth about the middle of July, followed by the most important pre-harvest application when high pressure (350 lb. or more) should be used to force the spray material through the foliage to the fruit. *S. fructicola* has been found in a viable state in old mummified fruits left for several years in the orchard, and the removal of these is therefore a valuable measure of control.

Home-made wettable 300- to 325-mesh sulphur, an inexpensive and efficient preparation for the control of *C. carpophilum* and *S. fructicola*, should be used at the rate of 5 to 6 lb. per 100 gals. water, with the addition of 4 to 5 lb. hydrated lime except for the pre-harvest spray. The wetting agents found to be most suitable for incorporation with the sulphur are fish-oil soaps, glutrin, goulac, and molasses; all except goulac are semi-liquid and should be used at the rate of 1 pint per 100 gals. to wet 10 lb. sulphur, goulac (a dust) being added in the proportion of 1 lb. per 100 gals. Effective commercial wettable sulphurs include kolofog [ibid., xvi, p. 542], flotation sulphur, mike sulphur [ibid., xvi, p. 659], micronized sulphur, sulcoloid, and crown sulphur. The zinc-lime spray [ibid., xvi, p. 477], introduced primarily for the control of bacterial shot hole of peach [*Bact. pruni*], is ineffectual for this purpose under local conditions but stimulates foliar development.

Wilson (E. E.). **The shot-hole disease of stone-fruit trees.**—*Bull. Calif. agric. Exp. Sta.* 608, 40 pp., 7 figs., 6 graphs, 1937.

Shot hole disease, caused by *Coryneum beijerinckii* [*Clasterosporium carpophilum*: *R.A.M.*, xvi, p. 393, and next abstract], consistently occasions loss to the peach, nectarine, almond, and apricot in California. The disease [the symptoms of which are described] affects the twigs, dormant buds, leaves, blossoms, and fruit but varies considerably in its severity on the different organs. The hot, dry Californian summer does not favour the development of the fungus, which survives on peaches as mycelium in the tissues of diseased twigs and buds, or as conidia produced within the blighted buds. On apricots the fungus survives in the blighted dormant buds, lesions on the twigs being rare, and on almonds as mycelium in the twig lesions, more particularly as mycelium and spores in the blighted dormant buds, and to some extent as mycelium and spores in the blighted blossoms that remain on the tree.

Rain is probably the most important factor in the dissemination of the fungus about the trees, since spores are not easily dislodged by air currents whereas drops of water carry numerous spores downward, and possibly, during strong wind, to other trees.

The interval between entry of the fungus into the host and the appearance of symptoms is from five to eight days in leaves, and from seven to about 20 days in twigs, but variations in temperature affect the length of the incubation period.

In two experiments leaf infection did not develop unless the leaves were kept moist for at least 24 hours after inoculation, and under the conditions prevailing in 1935–6 infection did not take place during the first autumn rains but occurred in abundance during long rainy periods in winter.

In control experiments on almonds over a period of three years, Bordeaux mixture (5–5–50 and 6–6–50) was more effective than lime-sulphur, coposil, and certain copper preparations. The application giving most satisfactory control on blossom buds, blossoms, and leaves was that applied first as the blossom buds were beginning to swell, but autumn applications controlled the twig infection more effectively. Sprays applied when the blossoms were emerging and later were valuable only as supplementary sprays. The results obtained from applications of Bordeaux mixture on various dates from 18th October to 16th December indicated that twig infection was more effectively controlled the nearer the date of application was to the beginning of the rain on 26th December. With almonds control of twig infection was not followed by a commensurate decrease in leaf infection but with peaches the sprays most effective against twig infection also gave the best control of leaf infection.

FAURE (J. F.). **Les traitements contre le Coryneum du Pêcher dans la vallée du Rhône.** [Measures for the control of the Peach *Coryneum* in the Rhone valley.]—*Progr. agric. vitic.*, cviii, 45, pp. 424–426, 1937.

Increasing injury is stated to be caused to the peach by *Coryneum* [*Clasterosporium carpophilum*] in the Rhone valley [*R.A.M.*, xii, p. 301], weak plants being particularly subject to the disease. For control the author recommends the application of Bordeaux mixture at leaf fall or even a little before, and one or two supplementary treatments between the beginning of November and January. Copper-calcium oxychlorides may only be used for spraying during the vegetation period.

BOUWENS (HENRIETTE). **Investigations about the mycorrhiza of fruit-trees, especially of Quince (Cydonia vulgaris) and of Strawberry plants (Fragaria vesca).**—*Zbl. Bakt.*, Abt. 2, xcvii, 1–3, pp. 34–49, 9 figs., 1937.

Mycorrhiza were observed by the writer in association with the roots of quince, pear, cherry, mulberry, apple, plum, and peach, in the Nijmegen district of Holland, where the first-named (the primary object of the investigations) is used as a stock for pears. Most of the material was supplied from Orleans and planted out in sandy soil, where the development of mycorrhiza is much more profuse than in

clay or peat. The endophyte was isolated as follows. In February mycorrhiza from quince taken from outdoor (non-disinfected) soil were placed in contact with young sterile quince plants in glass tubes on filter-paper in v. d. Crone's B solution, the roots of which were found by September to have developed an endophytic mycelium, arbuscles, and vesicles. From this material the endophyte was isolated on Burgeff's, X, and Melin 1b agars, of which the last-named proved to be the most suitable. The endophyte is a *Rhizoctonia* with a white aerial mycelium making zonate growth on cherry agar; clamp-connexions are not formed. In synthesis with sterile plants in pure cultures the fungus penetrates the roots and occupies the cells in the form of 'pelotons' ['balls of wool']; so far no vesicles have been detected. A species of *Cylindrocarpon* consistently isolated from quince roots failed to induce mycorrhizal formation on inoculation into sterile material, and a number of other oganisms tested also gave negative results.

Similar experiments with sterile strawberry seedlings of the Madame Moutot and other varieties also yielded a species of *Rhizoctonia* which produced mycorrhiza in inoculation experiments, whereas the *Pythium* and *Cylindrocarpon* isolated concurrently failed to do so. The strawberry *Rhizoctonia* resembles that of quince in its white, zonate mycelium without clamp-connexions, but differs in certain cultural characters. Yellow sclerotia are formed on X, malt, malt-salep, and oat agars. As in the case of quince the fungus develops in the cells in the form of 'pelotons', vesicles not having been observed hitherto.

WATERSTON (J. M.). **A note on the association of a species of Phytophthora with a 'die-back' disease of the Raspberry.**—*Trans. bot. Soc. Edinb.*, xxxii, 11, pp. 251–259, 2 pl., 2 figs., 1937.

The author states that since about 1932 a diseased condition of the Lloyd George raspberry, strongly resembling in its symptoms the black root rot described by Harris [*R.A.M.*, xi, p. 61], has been noticed locally in Scotland. The disease is characterized by the death of the young shoots, failure of buds on canes of the previous year to develop, the lack of extensive root formation in affected stools, and a definite die-back of the young roots from their tips. In the field the disease is restricted either to a few rows or to small localized patches, sometimes in hollows, suggesting excessive soil moisture as a predisposing factor. Dying roots were found regularly to contain Phycomycetous oospores enclosed in an elliptical oogonium; these oospores were also found in the roots of healthy stools from various localities in Scotland and in those of both healthy and black root rot stools in Kent. The oogonia vary in shape from broadly clavate to subspherical, and the oospores are spherical, hyaline to light yellow; in the four strains studied their mean diameter varied from 23·84 to 24·35 μ. Markedly papillate sporangia, 43 by 39 μ (mean), developed from diseased roots placed in tap water. The fungus is considered to belong to the *cactorum-omnivora* group of *Phytophthora*. The constant association of the organism with the disease, and the fact that in a stool with only one infected root, which was kept in water culture, the disease spread throughout the whole root system, while another one, from which all

roots showing infection had been carefully removed, remained healthy, lead the author to consider it a primary parasite, capable of assisting the invasion of the roots by secondary organisms under conditions unfavourable to the host.

WANN (F. B.) & RICHARDS (B. L.). **The effect of pH on two Strawberry root rot fungi.**—*Proc. Utah Acad. Sci.*, xiv, pp. 45–46, 1937.

In these further studies [*R.A.M.*, xvi, p. 822] on the etiology of strawberry root rot the author reports preliminary experiments on the effect of the hydrogen-ion concentration on growth of two of the root rot organisms, viz., *Fusarium orthoceras* and *F. solani*. The former yielded from 50 c.c. of a glucose-mineral nutrient culture medium a uniform dry weight of mycelium of about 75 mg. at reactions varying from P_H 3·4 to 6·5, increasing to 108 mg. at P_H 6·8, falling to 74 mg. at P_H 7·2, and rising to a maximum of 138 mg. at P_H 9·2. A second experiment gave similar results. *F. solani* gave nearly uniform growth between P_H 3·4 and 9·2, with a slight, doubtfully significant maximum at P_H 7·7. The author suggests that adjustment of the soil to P_H 7·2, by the addition of acid fertilizers such as ammonium sulphate, sulphur, and sulphuric acid, might exert a beneficial effect on control of the disease.

PAL (N. L.), CHATTERJI (U. N.), & RANJAN (S.). **Effect of gases, from brick kilns, on Mango crops.**—Abs. in *Proc. Indian Sci. Congr., 1937*, xxiv, pp. 270–271, 1937.

Gases emanating from brick kilns are stated to cause heavy damage to the mango crop in the Allahabad district of India, consisting in the formation of black spots (gradually hardening as the fruits mature) towards the distal end, retardation of growth of the fruits, and premature shedding of the same. A chemical examination of the diseased fruits revealed precocious physiological ripening with consequent premature senescence. The trees and their foliage were apparently not adversely affected.

SIMMONDS (J. H.). **Diseases of the Papaw.**—*Qd agric. J.*, xlviii, 5, pp. 544–552, 3 pl., 1937.

A brief account is given of the more important diseases of papaw in Queensland, among which black spot (*Ascochyta caricae*) [*R.A.M.*, xiv, p. 216] is stated to be probably the most serious. The other fungal troubles discussed include powdery mildew [*Sphaerotheca* sp.: loc. cit. and ibid., xv, p. 281]; ripe rots of papaw fruits, associated with *A. caricae* and *Gloeosporium* sp.; a watery rot of the fruits caused by *Rhizopus nigricans*, which may be avoided by careful handling of the fruit and other sanitary measures during packing; and foot rot of individual young and old papaw trees caused by *Pythium ultimum* [ibid., xi, p. 330], for the control of which it is recommended that diseased trees should be immediately removed, and that the resulting holes should not be replanted for some time. Yellow crinkle [ibid., xvi, p. 155] commonly appears during the late summer and is usually restricted to scattered individuals, though as much as 25 per cent. infection has been recorded; it is apparently more serious following a period of drought. While the exact cause of the disease is not yet known, available evidence suggests that

it is of a virus nature, and affected plants should be eliminated as soon as found. A die-back, characterized by a general yellowing of the leaves accompanied by the death of a few of the younger ones and eventually leading to the withering and death of all the leaves, is believed to be a physiological disorder, somewhat akin to blossom-end rot of tomatoes. It may develop in both young and old trees and those in vigorous as well as in poor condition; it is most prevalent during protracted dry spells and appears to be immediately related to periods of hot, drying winds. Similar symptoms may also be caused by a partial root rot, following excessive rain. The trouble may be controlled by careful irrigation of the soil, and by the removal of the dead tops of the trees.

De Montal (P.). **L'air comprimé pour les traitements des arbres fruitiers.** [Compressed air for the treatment of fruit trees.]—*Agric. prat., Paris*, N.S., ci, 50, pp. 1750–1752, 2 figs., 1937.

Experiments have been successfully carried out in the walnut-producing centre of Grenoble, France, with an equipment specially constructed by the Société Mil's, Lyons, and about to be placed on the market, based on the simultaneous compression of air and spray solution. The excessively fine spray engendered by the new apparatus acts like a dust, rapidly ascending and penetrating the densest foliage, and the amount of solution required (20 l. per tree for entire coverage) is reduced by at least 50 per cent. The working pressures of the apparatus are 5 and 3 kg. for large and medium-sized trees, respectively.

Marsh (R. W.), Martin (H.), & Munson (R. G.). **Studies upon the copper fungicides. III. The distribution of fungicidal properties among certain copper compounds.**—*Ann. appl. Biol.*, xxiv, 4, pp. 853–866, 1 pl., 1937.

In continuation of this series of investigations [*R.A.M.*, xii, p. 774], the authors give a tabulated account of field experiments from 1934 to 1936 at Long Ashton, the results of which indicated that, judging by their relative efficacy in the control of potato late blight (*Phytophthora infestans*), a wide range of copper compounds, namely, cuprous and cupric oxides, cuprous cyanide, cuprous sulphite, cupric phosphate, cupric ammonium silicate, and cupric oxychloride, share common fungicidal powers. In all the three years, which were marked by very diverse weather conditions, the amount of copper residue remaining on the potato foliage from the Bordeaux mixture was greater than that from either cuprous or cupric oxide, but the residues from the latter substances were superior in fungicidal power to Bordeaux residues of the same copper content. In a field trial on pears against scab (*Venturia pirina*) cuprous cyanide proved to be slightly inferior to oil-Bordeaux-arsenate spray of similar copper content, and when tested on apple against *V. inaequalis* it was shown to be pronouncedly injurious to the host.

Symposium and discussion on laboratory technique for evaluating fungicidal properties.—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 118–144, 1 fig., 5 graphs, 1937.

This is a collection of papers by various authors, which were read

at a symposium held in January, 1936, at University College, London. In the first H. B. S. Montgomery and M. H. Moore describe a method which is being perfected at the East Malling Research Station for the laboratory evaluation of the fungicidal properties of Bordeaux and other sprays. Briefly outlined, it consists in testing the toxicity to the conidia of *Venturia inaequalis* of dried deposits of Bordeaux mixture on chemically clean glass slides. The fungus is grown on pieces of sterilized apple wood, from which spore suspensions are obtained by washing the surface of the piece of wood with sterile distilled water, when the culture is 10 to 12 days old; the suspension is adjusted to give about 80 spores per 2 mm. field, and is then put on the dry deposit on the slides and incubated at 20° C. Germination counts are made before growth on the slides has developed far enough to produce secondary conidia. A brief discussion follows of some of the results so far obtained and of the further applications and developments of the method.

In a discussion of the physico-chemical aspects of laboratory trials of fungicides, H. Martin stresses the importance, in biological tests of a new product, of collateral physico-chemical tests designed not only for the purpose of defining the new product, but also for the elucidation of its mode of action. The significance of such methods is illustrated by the fact that in experiments on the control of potato blight [*Phytophthora infestans*] the higher efficacy of cuprous oxide during the dry season of 1934 was correlated with its high availability, while in the wet 1935 season cupric oxide was the more effective, owing to the fact that it is better retained on the host leaves than cuprous oxide. Once the specific and physical properties of a substance have been determined, laboratory testing is reduced to the evaluation of these properties, and thus, for instance, standardization by biological methods of lime-sulphurs can be replaced by the analytical determination of their content of polysulphide sulphur. The complexity of the problems involved in laboratory trials, in which one or more of the variable factors affecting fungicidal efficacy in the field are maintained constant, is illustrated by a discussion of the standard procedures adopted by different workers for the application of sprays or dusts to test surfaces, leading to the conclusion that if the results of biological toxicity trials are to be applied to practice, consideration must be paid to the physico-chemical properties of the preparations.

R. G. Tomkins briefly discusses the preliminary testing in the laboratory of preparations destined for the preservation of foodstuffs, in order to determine their specific action on the germination and growth of fungi, as well as their volatility, solubility, and other properties which may be of importance. He points out that detailed knowledge of the fungicidal properties of a substance often suggests ways of improving its fungicidal action.

W. P. K. Findlay gives an account of the laboratory testing of wood preservatives [ibid., xv, p. 133], W. A. R. Dillon Weston outlines the work which is being done at Cambridge in the testing of liquid and dust fungicides for the disinfection of seed [ibid., xvi, p. 442], and in another paper A. E. Muskett describes analogous researches which are being carried out in Northern Ireland; he also briefly describes the

methods employed in Germany in official and industrial tests of seed-disinfecting preparations, as seen by him during a visit to that country in 1934.

Gallwitz (K.). **Untersuchungen an Leichtmetallen in Pflanzenschutzspritzbrühen.** [Investigations on light metals in plant-protective spray mixtures.]—*Tech. in d. Landw.*, xviii, 12, pp. 226–228, 2 figs., 1 graph, 1937.

Only two of the alloys tested as substitutes for brass in the construction of spraying apparatus [*R.A.M.*, xvi, p. 825] gave any indication of possible utility in tests with 2 per cent. nosprasit 0, 2 per cent. nicotine, 10 per cent. Wacker's kupferkalk, and 15 per cent. lime-sulphur, and both of these consisted of rolled tin covered with a layer of eloxide, the adaptation of which to the purpose in view presents various technical difficulties.

Mol (Wilhelma A.). **Die Schimmelprobe.** [Testing for mould.]—*Z. Untersuch. Lebensmitt.*, lxxiv, 2–3, pp. 189–191, 1937.

The standard Dutch method of testing foodstuffs for mould contamination being open to various objections, the writer devised the following improved procedure. One gram of the substance to be examined is ground in a sterile mortar and converted with 10 c.c. sterile water into a homogeneous suspension, 1 c.c. of which is transferred by means of a sterile pipette to a Petri dish, mixed with 10 c.c. melted plum agar cooled to 45° C., and kept for three days in an incubator at 25°, this temperature being chosen to avoid the overrunning of the plates at 30° or above by *Aspergillus niger* and other *A.* spp., which prevent the recognition of *Penicillium glaucum.* It was further found advisable to add 1 gm. copper sulphate per 1,500 c.c. plum agar to prevent the overgrowth of the mould colonies by the greyish-white mycelium of *Mucor stolonifer* [*Rhizopus nigricans*]. Using this method of testing, mouldy cacao was usually found to form more than 50 colonies per 0·1 gm. agar. Maizena samples yielding more than 25 colonies per 0·1 gm. are unfit for consumption. In the case of nutmeg and pepper [*Piper nigrum*], a low incidence of mould contamination is correlated with a high etherial oil content, and the purity of these spices is best judged by the standard method of incubation (but at 25° instead of 37°).

Galloway (L. D.) & Burgess (R.). **Applied mycology and bacteriology.** —ix+186 pp., 1 pl., 20 figs., 1 diag., London, Leonard Hill, Ltd., 1937. Price 10*s*.

This manual is admittedly a mere review of essentials, intended to assist biologists and chemists in the co-ordination of their studies with those of other workers and give some indication of the scope and methods of economic microbiology. Part I deals with general matters, while Part II is concerned with specific applications to the food, fermentation, and textile industries [*R.A.M.*, xvii, p. 35], hygiene and medicine, agriculture, and miscellaneous industrial problems.

Heald (F. D.). **Introduction to plant pathology.**—xi+579 pp., 200 figs., London, McGraw-Hill Publishing Co., 1937. Price 24*s*.

This useful and well-produced treatise is described in the author's

preface as the outcome of 'a demand from teaching plant pathologists for a somewhat briefer treatment of the subject' than that followed in the 'Manual of Plant Diseases' [*R.A.M.*, vi, p. 109]. The present work, however, is not an abridgment of the earlier volume, but includes much added material, and involves an entirely different mode of presentation. The work is divided into six sections in which are discussed, respectively: general introductory subjects; diseases caused by Phycomycetes, Ascomycetes, Basidiomycetes, Fungi Imperfecti, and bacteria; virus diseases; non-parasitic diseases; plant disease control; and plant pathology methods. The results of recent advances in the various aspects of the subject have been incorporated as far as possible in the text.

Köhler (E.). **Neuere Vorstellungen von der Natur des pflanzenpathogenen Virus. Sammelreferat.** [Recent conceptions of the nature of the plant-pathogenic virus. A symposium.]—*Z. Bot.*, xxxi, 12, pp. 559–571, 1937.

This is a critical survey of some recent outstanding contributions to the understanding of plant viruses.

Findlay (G. M.). **Viruses and virus diseases.**—*Lancet*, ccxxxiii, 5959, pp. 1139–1140, 1937.

In the course of a paper on the nature of viruses read before a pathological meeting of the Liverpool Medical Institution on 28th October, 1937, attention was drawn to recent developments in the isolation of heavy proteins, probably nucleoproteins, from plant tissues infected by tobacco mosaic, tobacco ring spot, cucumber mosaic, potato X virus, and the bacteriophage, as well as from rabbit papillomata [*R.A.M.*, xvii, p. 52], equine encephalomyelitis, and yellow fever. Some of these heavy proteins can be obtained in crystalline and para-crystalline form and are apparently themselves the viruses, though it has been suggested that they are proteinases, capable of self-synthesis.

Peyronel (B.). **Le 'Endogone' quali produttrici di micorrize endotrofiche nelle fanerogame alpestri.** [The species of *Endogone* producing endotrophic mycorrhiza in Alpine phanerogams.]—*Nuovo G. bot. ital.*, N.S., xliv, 3, pp. 584–586, 1937.

Two of the species of *Endogone* previously reported [*R.A.M.*, iv, p. 755] to form endotrophic mycorrhiza in the roots of certain phanerogams in the Waldensian valley, Italy, are here referred to *E. vesiculifera* Thaxter and *E. fuegiana* Speg., the former occurring in *Viola palustris* and probably also in *Potentilla tormentilla*, *Caltha palustris*, and *Epilobium* spp., and the second in *V. palustris*, *Peucedanum ostruthium*, and *P. verticillare*. Other species of *Endogone*, as yet unidentified, have been found forming mycorrhiza in *Euphorbia dulcis*, *Phyteuma halleri*, *Lathyrus montanus*, and *Gentiana acaulis*.

Peyronel (B.). **Osservazioni e considerazioni sul fenomeno della micorrizia al Piccolo San Bernardo.** [Observations and reflections on the phenomenon of mycorrhizal development in the Little St. Bernard.]—*Nuovo G. bot. ital.*, N.S., xliv, 3, pp. 586–594, 1937.

Most of the wild plants growing in the Little St. Bernard region

(Piedmont) are stated to be furnished with mycorrhiza, which are little in evidence, on the other hand, among the species cultivated in the Alpine garden 'Chanousia'. Plants provided with endophytic mycorrhiza may be divided into two groups according to the nature of their rootlets—large and succulent or slender and filamentous. The extra-radical development of the mycorrhizal mycelium, frequently profuse, facilitates the passage of the organism from one host to another. The possible bearing of the scarcity of mycorrhiza in the Alpine garden on the poor condition of certain plants cultivated therein is discussed, but it is pointed out in this connexion that some of these also suffer from root rots due to *Rhizoctonia*, e.g., in *Thlaspi rotundifolium*, *Gypsophila repens*, and *Oxytropis foetida*, and to *Fusarium* in *O. parvupassuae*.

WILSON (A. R.). **Apparatus for growing plants under controlled environmental conditions.**—*Ann. appl. Biol.*, xxiv, 4, pp. 911–931, 2 pl., 8 diags., 1 graph, 1937.

The author gives a detailed account of the modifications introduced by him in 1935–6 to the Rothamsted chambers for growing plants under controlled conditions described by Stoughton [*R.A.M.*, ix, p. 523]. The new features include an inexpensive cooling apparatus, allowing the maintenance of temperatures inside the chamber as low as 5° C. at outer room temperatures of 16° to 18°. The type of humidifier adopted depends on the passage of air through a fine water mist from an atomizer device, and air is dried by passage over calcium chloride. Further details are an inexpensive, simple, and accurate lineametric, hair-operated hygrostat, controlling humidity within 2 per cent., a rough control of wind velocity within the chamber, and a semi-automatic watering device.

LIPMAN (C. B.). **Tolerance of liquid air temperatures by spore-free and very young cultures of fungi and bacteria on agar media.**—*Bull. Torrey bot. Cl.*, lxiv, 8, pp. 537–546, 1 pl., 1937.

Experiments are described in which a number of fungi and bacteria were exposed to liquid air temperatures on normal media for 48 hours. Of the 12 fungi tested, 8 (including *Penicillium luteum*, and species of *Mucor*, *Absidia*, *Mortierella*, *Trichoderma*, and *Fusarium*) grew normally after such exposure. *Erwinia amylovora* showed growth microscopically but not macroscopically whereas all the other bacteria (including *E. carotovora*) made copious growth.

KÖHLER (E.). **Ueber eine äusserst labile Linie des X-Mosaikvirus der Kartoffel.** [On an extremely unstable strain of the X-mosaic virus of the Potato.]—*Phytopath. Z.*, x, 5, pp. 467–479, 6 figs., 1937.

From the X-potato mosaic virus strain Cs 35 [*R.A.M.*, xvi, p. 704] the writer isolated a further strain, herein designated Cs 36, causing much more severe necrosis of Samson tobacco leaves, in the shape of confluent, conspicuously pale yellow, concentrically zonate lesions, than the parent form, but characterized by extreme instability. This was expressed by the frequent development of weaker variants, some approximating in virulence to the moderately strong parent strain Cs 35, while others more closely resembled the feebler strain Cs A from

which Cs 35 originated. Still fainter symptoms were induced by the new variant Cs n which may almost be termed latent. Cs 36 succumbed to ten minutes' heating at 67° C., whereas Cs 35 and Cs A were still capable of producing, respectively, moderate and slight necrosis after heating to 70°. In immunization experiments with the Mb 12 virus on tobacco leaves only partial protection against Cs 36 was obtained, necrotic rings appearing at and near the tips to which the defensive principle had presumably not penetrated. The symptoms induced by Cs 36 were uniformly observed to develop much more slowly than those following inoculation with Cs 35 and Cs A, and this retarded motion through the tissues is tentatively attributed to the comparatively large size and weight of the virus particles. Constitutional modifications of the latter are further held to be responsible for the variation phenomena reflected in the erratic appearance of the mutants described above. Such changes may be conceived as graduated associations and dissociations of molecules of the virus protein, and in the case of the excessively virulent Cs 36 are probably correlated with a progressive disintegration of the protein complex.

KAUSCHE (G. A.). **Zur Frage der Beziehungen zwischen Virusinfekt und Stoffwechselphysiologie bei pflanzlichen Virosen.** [A contribution to the question of the relationships between virus infection and metabolic physiology in plant viroses.]—*Biochem. Z.*, ccxciv, 5–6, pp. 365–371, 3 graphs, 1937.

Samson tobacco leaves inoculated with a mixture of the H_{19s} and Cs 35 (X+X) potato viruses [see preceding abstract] underwent no severe malformations or stunting, whereas an X+Y blend produced an excessively dwarfing effect on the host. Buffering was increased in the infected plants, as compared with the controls, in both these experiments, especially the latter [ibid., xvii, p. 129]. The redox potentials of plants inoculated with an X+Y mixture were generally found to lie nearer the negative region of the scale than those of the controls, but these relationships may be reversed, and there were cases in which the curves overlapped.

The results of these tests do not appear to justify the conclusion that changes in the buffering of diseased plants arise exclusively as a sequel to virus infection, and any such connexion, even if convincingly demonstrated, would be applicable only within a limited scale of virus concentrations.

HEINZE (K.) & BÖRGER (H.). **Versuche zur Übertragung von Kartoffelvirosen auf Kartoffelsämlinge.** [Experiments in the transmission of Potato viruses to Potato seedlings.]—*Landw. Jb.*, lxxxv, 2, pp. 165–180, 7 figs., 1937.

Experiments were carried out at the Biological Institute, Berlin-Dahlem, to ascertain the feasibility of precocious seedling infection with certain potato viruses with a view to furthering the work of breeding for resistance by the timely elimination of susceptible individuals. The seedlings used were the W strains 25/31, 32/31, 23/34, 67/34, and the 9089 variety, all bred at the Institute. The peach aphids

(*Myzus persicae*) employed in the transmission tests were allowed to feed, mostly for a fortnight or more, on diseased potatoes prior to transference to healthy material.

When the insects infected with leaf roll were placed on the leaves of the seedlings, the symptoms developed so rapidly that more than half could be eliminated before transplanting to the field, while an even earlier appearance resulted from the infestation of the radicles of germinating seeds on damp blotting-paper in Petri dishes. The streak (Y) virus, non-transmissible by means of aphids, was successfully carried from infected to sound plants with the aid of a metal pipette (injection spray), followed by rubbing of the foliage. Definite streak symptoms were manifested long before the time for transplanting to the field. Attempts to transmit leaf roll when blended with streak (Y) by means of *M. persicae* gave much less successful results than when the leaf roll virus was used alone.

Boerger (A.). **Abbau-Erscheinungen, Saatgut-, Sorten-Fragen u.a. im Kartoffelbau. Sorgen um den Kartoffelbau in Südamerika.** [Degeneration manifestations, seed and variety problems, and so forth, in Potato cultivation. Anxieties concerning Potato cultivation in South America.]—*Dtsch. landw. Pr.*, lxiv, 46, pp. 559–560, 4 figs., 1937.

The steady increase of potato degeneration due to virus diseases, including leaf roll, in the Argentine during the last four years [*R.A.M.*, xv, p. 823; xvii, p. 57], culminating in the disastrous failure of the 1936–7 harvest, has necessitated the reorganization of the Uruguayan seed tuber supply, formerly largely met from this source. At the moment the seed for the winter plantings is mainly provided by New Zealand material. During 1936–7 the Argentine Ministry of Agriculture, with the aid of a special grant made in June, 1936, purchased 4,000 tons of certified seed [ibid., xvi, p. 144] of the Green Mountain, Katahdin, and Chippewa varieties from Canada and the United States, while a total of 6,870 tons was imported from North America and Europe by the trade. In February, 1937, the writer inspected the Argentine plantings and was greatly impressed by the superior health and productivity of the imported certified stock as compared with the degenerate native Chaqueña and Americana blanca stands. The economic aspects of the situation arising out of this reconstitution of the South American potato supply are briefly considered.

Smith (A. M.) & Paterson (W. Y.). **The study of variety and virus disease infection in tubers of Solanum tuberosum by the ascorbic acid test.**—*Bio-chem. J.*, xxxi, 11, pp. 1992–1999, 2 graphs, 1937.

A large number of healthy and diseased potato tubers (the latter infected by viruses or *Phytophthora infestans*) from the 1935, –6, and –7 crops in several Scottish centres were examined for ascorbic acid [*R.A.M.*, xvi, p. 707; cf. also ibid., xvi, p. 777] by the usual method of extraction with trichloroacetic acid and titration with 2:6-dichlorophenol-indophenol, as well as by a modification suitable for rapid routine purposes in which the cores were merely shaken for one minute

with 2 ml. 2 per cent. trichloroacetic acid and the mixture titrated with the indicator.

The effects of disease were studied by examining samples of six tubers certified as affected by different maladies after one month's storage. With one or two exceptions, tubers infected with mild and severe mosaic gave the same results within the limits of experimental error, and a mean figure has therefore been given for mosaic as a whole. The relatively few cases of leaf roll among the experimental material yielded data similar to those obtained from mosaic tubers. In both instances the reducing material is significantly greater (with one exception) than in comparable sound stock after the same storage period—an observation considered to be of great value as affording a simple means of testing the presence of virus infection in tubers. The following are some selected figures (in ml.) representing the amount of indophenol reduced by healthy and diseased tubers of certain varieties: Arran Pilot, healthy, mosaic, and blight, $1{\cdot}48\pm0{\cdot}08$, $2{\cdot}10\pm0{\cdot}05$, and $1{\cdot}09\pm0{\cdot}02$, respectively; similarly Eclipse, $2{\cdot}45\pm0{\cdot}07$, $3{\cdot}41\pm0{\cdot}09$, and $2{\cdot}03\pm0{\cdot}08$, respectively; Sharpe's Express $2{\cdot}66\pm0{\cdot}07$, $3{\cdot}33\pm0{\cdot}10$, and $1{\cdot}64\pm0{\cdot}08$, respectively; and King Edward, $2{\cdot}73\pm0{\cdot}08$, $3{\cdot}20\pm0{\cdot}14$, and $1{\cdot}71\pm0{\cdot}06$, respectively; Majestic, healthy, mosaic, leaf roll, and blight, $1{\cdot}54\pm0{\cdot}66$, $2{\cdot}37\pm0{\cdot}09$, $2{\cdot}15\pm0{\cdot}08$, and $1{\cdot}36\pm0{\cdot}05$, respectively; similarly Great Scot, $1{\cdot}88\pm0{\cdot}06$, $2{\cdot}30\pm0{\cdot}10$, $2{\cdot}29\pm0{\cdot}05$, and $1{\cdot}47\pm0{\cdot}04$, respectively; and Arran Banner, $2{\cdot}22\pm0{\cdot}07$, $3{\cdot}47\pm0{\cdot}11$, $2{\cdot}87\pm0{\cdot}05$, and $1{\cdot}66\pm0{\cdot}03$, respectively. It is of interest in this connexion to observe that blight-infected tubers contain less reducing substance than healthy ones.

The extreme variability of the ascorbic acid content of potato tubers, as manifested in the test material, appears to be independent of size, weight, soil constitution and manuring, and possibly also of seasonal conditions, being evidently correlated rather with varietal characters, health, and storage factors (especially duration). In general, a relatively low ascorbic acid content was associated with susceptibility to virus diseases (e.g. $5{\cdot}91\pm0{\cdot}9$ mg. per 100 gm. tuber substance in Redskin) and a relatively high one with resistance ($8{\cdot}21\pm0{\cdot}18$ in Kerr's Pink), but this rule was found to admit of occasional exceptions.

Stevenson (F. J.), Schultz (E. S.), Clark (C. F.), Cash (Lillian), & Bonde (R.). **Breeding for resistance to late blight in the Potato.**—*Phytopathology*, xxvii, 11, pp. 1059–1070, 2 figs., 1937.

Some of the results obtained in the writers' experiments in breeding potatoes for resistance to late blight (*Phytophthora infestans*) in the field in Maine and in the greenhouse at Beltsville, Maryland, have already been noticed from another source [*R.A.M.*, xvi, p. 54]. Certain progenies of crosses between two resistant varieties, e.g., No Blight × Ekishirazu, are all resistant, while a comparatively large number of seedlings raised from seed of German origin has escaped infection for three years. Resistance in such cases is not necessarily correlated with desirable commercial features, but the combination has been secured by crosses between (a) two resistant varieties, S45349 and Ekishirazu, (b) No Blight and Katahdin, and (c) two susceptible varieties, Chippewa and Katahdin. The tubers of a number of the varieties with resistant

vines are also resistant to the tuber rot caused by *P. infestans*. In plots sprayed with Bordeaux mixture, three of the resistant varieties tested were in the same class as the susceptible Green Mountain in yield, but in the untreated plots the differences between susceptible and resistant varieties were highly significant.

From the data obtained it is evident that blight resistance in the cultivated varieties is inherited as a recessive character, probably controlled by multiple genes.

GOOSSENS (J.). **Aantastingen van Aardappelknollen van het ras Bintje door Alternaria solani in verband met beschadigingen en den rooidatum.** [Attacks on Potato tubers of the Bintje variety by *Alternaria solani* in relation to injuries and the date of lifting.]—*Tijdschr. PlZiekt.*, xliii, 11, pp. 266–277, 2 pl., 4 graphs, 1937. [French summary.]

During the winter of 1935–6 the writer repeatedly examined a batch of Bintje potato tubers (750 kg.) for the presence of *Alternaria solani* [*R.A.M.*, xiii, p. 54], removing the diseased tubers at each inspection. Fresh infections, however, continually developed on the hitherto apparently sound material, mostly (in 415 out of 480 cases) in cortical abrasions, at the hilum, or in mechanical injuries. In inoculation tests through wounds the fungal spots were sometimes formed at a short distance from the actual site of infection. In some cases the spots produced by the fungus in the interior of the tubers were so minute as readily to escape detection in the early stages of the disease. The results of inoculations through the hilum and wounds on tubers lifted on four dates between 13th July and 7th September indicate that, on the whole, infection is most prevalent on early dug potatoes.

MADER (E. O.) & MADER (MARY T.). **Effect of Bordeaux mixture on three varieties of Potatoes with respect to yields, composition of tubers, and control of scab.**—*Phytopathology*, xxvii, 11, pp. 1032–1045, 2 graphs, 1937.

Bordeaux mixture, of different concentrations, applied in varying doses at the rate of 100 gals. per acre at 400 lb. pressure, entailing a total consumption of copper sulphate of 75 lb. per acre for the season, retarded the flowering of Irish Cobbler and Green Mountain potatoes. The tuber and foliage weights of these two varieties and Rural Russet exceeded those of untreated plants, and all the sprayed plants retained more tubers per plant than the controls. Tubers of sprayed plants of all varieties showed a marked reduction in the percentage of scab [*Actinomyces scabies*: *R.A.M.*, xiv, p. 716] as compared with those from the untreated controls. In the early stages of tuber enlargement, the largest tubers of both treated and untreated plants were more extensively infected by scab than the smaller ones, but scabby tubers developed more slowly than sound ones, so that a higher percentage of diseased tubers fell into the smaller weight classes at maturity. At maturity the tubers from sprayed plants contained more copper, total nitrogen, reducing sugar, and starch, than those from untreated ones, with a lower ratio of protein to starch.

Svinhufvud (V. E.). **Untersuchungen über die bodenmikrobiologischen Grundlagen der Cajanderschen Waldtypen.** [Studies on the soil microbiological foundations of Cajander's forest types.]—*Erdész. kisérl.*, xxxix, 3–4, pp. 311–336, 1937.

The results of the writer's studies in Finland on the relation of the various groups of soil fungi and other micro-organisms to different forest types on the basis of Cajander's system of classification have already been noticed from another source [*R.A.M.*, xvi, p. 710].

Borzini (G.). **Su di un attacco di Sclerotinia libertiana Fuck. in piante di Finocchio e sul parassitismo della stessa in associazione con altri funghi.** [On an attack of *Sclerotinia libertiana* Fuck. on Fennel and its parasitism in association with other fungi.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 2, pp. 225–266, 14 figs., 1937.

This is an expanded account of a paper on *Sclerotinia libertiana* [*S.* sclerotiorum] already noticed from another source [*R.A.M.*, xvii, p. 135].

Stevenson (G. C.). **Studies on gumming disease of Sugar Cane.**—*Bull. Brit. W. Ind. centr. Sug. Cane Breed. Sta.* 16, pp. 1–9, 1937.

In the first part of this paper, the author gives an expanded account of tests of 20 varieties of sugar-cane for resistance to gumming disease (*Bacterium vasculorum*) by the gum exudation method previously described [*R.A.M.*, xvi, p. 410]. The tabulated data show that in seven varieties with either very slight or no leaf symptoms no gum exudation occurred, whereas those varieties exuding appreciable quantities of gum manifested heavy or very heavy leaf symptoms. There was, however, no essential correlation between severe leaf symptoms and high gum exudation for B. 3316; B. 3369 and Ba. 11569 showed marked leaf symptoms but relatively little gum exudation.

In continuation of his studies on the inheritance of resistance to gumming disease, the author gives data supplementary to those already published [ibid., xv, p. 397]. The effect of the male parent is clearly seen in crosses with the very susceptible Ba. 11569 as female parent, the resistance of the progeny from crosses with Ba. 6032, B. 606, B. 603, S.C. 12/4, B.H. 10 (12), and B. 417 (ranging in sequence from very susceptible to very resistant), being 27, 67, 78, 68, 82, and 87, respectively. A very high percentage of resistant types has appeared in progenies of crosses involving *Saccharum spontaneum* and *S. barberi*, and, even in the fourth and fifth nobilizations in the 'glagah' blood line, resistance percentages of from 96 to 100 per cent. are found.

Petch (T.). **Yorkshire Hypocreales.**—*Naturalist, Lond., 1937*, 970, pp. 279–283, 1937.

In this list of Hypocreales recorded from Yorkshire the following items are mentioned. The fungus causing apple canker [*Nectria galligena*] is listed as *Dialonectria galligena* (Bres.) Petch [presumably a new combination], *N. ditissima* is referred to *N. punicea* (K. & S.) Fr., and *Claviceps microcephala* is given as a synonym of *C. purpurea* found on the inflorescence of grasses [*R.A.M.*, xvii, p. 104].

Baker (R. E. D.). **Additions and corrections to the further preliminary list of Trinidad fungi by C. A. Thorold, 1931.**—*Trop. Agriculture, Trin.*, xiv, 11, pp. 316–319, 1937.

This is a list, arranged in the systematic order of the organisms, of 110 species of fungi recorded in Trinidad since the publication of Thorold's previous list [*R.A.M.*, xi, p. 474]. Included in the number are 49 species of *Cercospora* collected in 1933 and 1934 by W. F. Steven, a number of which were identified by C. Chupp.

Peyronel (B.). **Sulla presenza della 'Valdensia heterodoxa' in Val d'Aosta e sul suo isolamento in cultura pura.** [On the presence of *Valdensia heterodoxa* in Val d'Aosta and on its isolation in pure culture.]—*Nuovo G. bot. ital.*, N.S., xliv, 3, pp. 581–583, 1937.

Attention is drawn to the recent detection on *Vaccinium myrtillus*, *Oxalis acetosella*, *Mulgedium alpinum*, and *Adenostyles alpina* in Val d'Aosta of *Valdensia heterodoxa*, formerly observed by the writer in the Waldensian valleys of Piedmont and also occurring in the U.S.S.R. and Poland [*R.A.M.*, viii, p. 631]. The number of hosts now known to be attacked by the fungus is 33. Pure cultures were obtained as follows. Leaves bearing the propagative organs of the fungus were placed on damp blotting-paper in Petri dishes and covered, at a height of 1 to 2 cm., with a broad sheet of flamed glass. In a short time the bulbils are shot from the leaves and adhere to the glass, from which they are readily detached by means of a platinum needle and transferred to carrot agar. On this medium *V. heterodoxa* does not produce its characteristic organs of propagation, but exclusively sclerotia and microconidia closely resembling those of *Sclerotinia fructigena*, *S. cinerea*, and allied species, to which the fungus under discussion is probably nearly related.

Yen (W. Y.). **Note sur quelques Ustilaginées marocaines.** [Note on some Ustilagineae from Morocco.]—*Rev. Mycologie*, N.S. ii, 2, pp. 76–84, 5 figs., 1937.

An account is given of the author's cultural studies on three of the five species of smuts sent to him from Morocco by Malençon, among which special mention may be made of *Sphacelotheca columellifera* (Tul.) Yen [a revised description of which is appended] on *Andropogon laniger*, and *S. schweinfurthiana* on *Imperata cylindrica*.

Watzl (O.). **Über die Bäume und Sträucher des von der Baramba entwässerten Gebietes der Chodschalgruppe und deren Blattkrankheiten. (Ein Beitrag zur Flora des südwestlichen Zentralkaukasus.) II. Pilze an lebenden Blättern.** [On the trees and shrubs of the region of the Khodja group drained by the Baramba and their leaf diseases. (A contribution to the flora of the south-western central Caucasus.) II. Fungi on living leaves.]—*Beih. bot. Zbl.*, Abt. B, lvii, 3, pp. 431–440, 1937.

In this list of about 40 fungi (identified by F. Petrak) observed parasitizing leaves of trees and shrubs in the Khodja region of the south-western central Caucasus (U.S.S.R.) in 1928 are included *Creoseptoria watzlii* Pet. n.g., n.sp. (with filamentous, hyaline, indistinctly

pluriseptate conidia, differing from *Septoria* in its typically hypocreoid features) on *Alnus glutinosa* var. *denticulata*, and *Petrakia deviata* n.sp. on *Acer campestre* var. *leiocarpum*.

MORITZ (O.). **Neuere biochemische und serologische Arbeiten auf dem Gebiet der pflanzlichen Viruskrankheiten.** [Recent biochemical and serological studies in the field of plant virus diseases.]—*Phytopath. Z.*, x, 5, pp. 554–558, 1937.

The author summarizes the outcome of some recent outstanding biochemical and serological contributions [all of which have been noticed in this *Review*] to the knowledge of the tobacco mosaic virus protein and certain other viruses.

GRATIA (A.) & MANIL (P.). **De l'ultracentrifugation des virus des plantes.** [On the ultracentrifugation of plant viruses.]—*C.R. Soc. Biol., Paris*, cxxvi, 27, pp. 423–425, 1937.

In further studies on the ultracentrifugation of tobacco mosaic [*R.A.M.*, xvii, p. 207] it was found convenient to combine this process with Bawden's technique of heating the juice to 70° C. for a few moments and then adding 1 part of a saturated solution of ammonium sulphate containing 5 per cent. glacial acetic acid to 3 parts of the purified liquid. The resulting precipitate, of a mother-of-pearl-like appearance and silky texture, consists exclusively of Stanley's crystals. These are absent, however, from material of *Nicotiana glutinosa*, with local lesions due to the same virus, treated by the foregoing technique.

GRATIA (A.) & MANIL (P.). **Ultracentrifugation et cristallisation d'un mélange de virus de la mosaïque du Tabac et de bactériophage.** [The ultracentrifugation and crystallization of a mixture of the Tobacco mosaic virus and bacteriophage.]—*C.R. Soc. Biol., Paris*, cxxvi, 32, pp. 903–906, 1937.

Details are given of an experiment in the ultracentrifugation of a mixture of tobacco mosaic protein and the bacteriophage of [*Bacterium*] *coli* [*R.A.M.*, xv, p. 140], in which the latter was largely absorbed by the crystalline precipitate of the former. After the third recrystallization the mosaic protein still retained a strong bacteriophagic capacity, which had in fact sunk only from 10^6 to 10^4. This process of intensive assimilation of an entirely alien element by the tobacco mosaic protein is considered to afford an important clue to the virulence of Stanley's crystals [see preceding abstract].

MANIL (P.) & DRICOT (C.). **Relations entre le nombre de lésions et la concentration du virus infectant dans le cas de la mosaïque du Tabac sur Nicotiana glutinosa.** [Relations between the number of lesions and the concentration of the infective virus in the case of Tobacco mosaic on *Nicotiana glutinosa*.]—*C.R. Soc. Biol., Paris*, cxxvi, 32, pp. 918–922, 1937.

The following equation has been found useful in the calculation of the relationships between the number of lesions and the concentration

of tobacco mosaic on *Nicotiana glutinosa*: $Y = KX\frac{1}{n}$, in which $Y =$ the number of lesions, $X =$ the relative concentration of the virus, and K and n are constant factors [cf. *R.A.M.*, xvii, p. 207]. Some recent studies along similar lines are briefly discussed.

LORING (H. S.). **Accuracy in the measurement of the activity of Tobacco mosaic virus protein.**—*J. biol. Chem.*, cxxi, 2, pp. 637–647, 1937.

A comparison of the differences in the number of lesions produced by the same percentage difference in tobacco mosaic virus protein concentration [see preceding abstract] over a range of 10^{-9} to 10^{-4} gm. protein per c.c. indicates that the optimum concentration for the comparison of different samples of crystalline virus protein is about 10^{-6} gm. per c.c.

The results [which are fully tabulated and discussed] of a number of tests showed that differences in virus protein concentration of 10 per cent. or more are readily detectable by the half leaf method on Early Golden Cluster bean (*Phaseolus vulgaris*) when 40 to 50 leaves are used. When *Nicotiana glutinosa* serves as the test plant, the minimum difference in concentration that can be consistently distinguished with the same number of leaves is 20 per cent.

SEASTONE (C. V.), LORING (H. S.), & CHESTER (K. S.). **Anaphylaxis with Tobacco mosaic virus protein and hemocyanin.**—*J. Immunol.*, xxxiii, 5, pp. 407–418, 1937.

Crystallized tobacco mosaic virus protein, as shown by previously published data, fails to cause smooth muscle contraction in guinea-pig uteri *in vitro* [*R.A.M.*, xvi, p. 65], though it is anaphylactogenic when tested *in vivo* on sensitized animals. It has been suggested that the failure to obtain anaphylactic reactions *in vitro* may be due to the large size of the tobacco mosaic virus protein molecules [ibid., xvi, p. 212 *et passim*], and this hypothesis was to some extent confirmed by the positive results secured both in the isolated uterine horn and *in vivo* with the haemocyanin of the horseshoe crab, *Limulus polyphemus*, the molecular weight of which is only about one-sixth of that of the virus protein.

FRANKE (H. M.). **Die Neutralisation des klassischen Virus durch Preßsäfte lokalresistenter Pflanzen. (Vorläufige Mitteilung.)** [The neutralization of the ordinary virus by the expressed juices of locally resistant plants. (Preliminary note.)]—*Planta*, xxvii, 4, pp. 399–404, 1937.

A fully tabulated account is given of experiments in the neutralization of the ordinary tobacco mosaic virus by the expressed juice of the locally resistant *Nicotiana glutinosa* [see preceding abstract], the results of which point to the inactivation of the former by this means. However, pending the elaboration of more delicate technique, the complex problems arising out of this line of research cannot be thoroughly investigated.

WENT (JOHANNA C.). **The influence of various chemicals on the inactivation of Tobacco virus 1.**—*Phytopath. Z.*, x, 5, pp. 480–489, 3 graphs, 1937.

The action of certain chemicals on tobacco mosaic virus 1 was tested by means of the local lesion method, using hybrids of *Nicotiana glutinosa*×*N. tabacum* as host plants [*R.A.M.*, xv, p. 611]. Copper sulphate, mercuric chloride, and silver nitrate were found to cause extensive inactivation of the virus at concentrations of 0·25 to 1 per cent. [ibid., xv, p. 177], this effect increasing at higher dilutions of the virus when made prior to treatment with the chemical. However, when the virus-chemical mixture is diluted after treatment the virus appears to be reactivated. This reactivation occurs both with unpurified and purified dialysed virus, tested with copper sulphate and mercuric chloride, but not with silver nitrate, except that the latter permitted a partial reactivation (up to 20 per cent.) of the treated purified dialysed virus.

ROSS (A. F.) & VINSON (C. G.). **Mosaic disease of Tobacco. Action of proteoclastic enzymes on the virus fraction. Nature of the virus fraction from various species of plants.**—*Res. Bull. Mo. agric. Exp. Sta.* 258, 19 pp., 1937.

In continuation of the second-named writer's previous studies on the nature of the tobacco mosaic virus [*R.A.M.*, xiii, p. 658], the effect of trypsin [ibid., xiv, p. 199, and above, p. 209] on the infective principle under different conditions was investigated. Commercial trypsin was added to several types of purified preparations at the rate of 2 mg. per c.c., controls with an equal amount of the heat-inactivated enzyme also being maintained. The virulence of the treated preparations was determined by pin prick inoculations into young Turkish tobacco plants. The resultant data indicated that the inactivation of the virus by trypsin, which occurred within an hour of its addition to the preparations, is mainly due to adsorption. Similar experiments with pepsin [ibid., xiv, p. 260] denoted a gradual inactivation (in seven days) of the virus at P_H 3.

A method of purification is described, involving the use of amyl alcohol for the decomposition of the virus-safranin precipitate, which greatly reduces the ash content of the final preparation. Such preparations are believed to be as pure as those obtained by previous procedures, if not more so. Purified virus preparations from Turkish tobacco, *Nicotiana macrophylla*, *N. paniculata*, *N. trigonophylla*, *N. longifolia*, *Lycopersicum pimpinellifolium*, and Golden Pear tomatoes all contained roughly 16 per cent. nitrogen and 1 per cent. ash, calculated on the basis of the total solids present. The nitrogen content of purified virus preparations from twelve other plants ranged from 0·9 mg. per l. in King of Denmark spinach to 28·1 in *N. suaveolens* and 27 in *Hyoscyamus niger*, the presence of small amounts being correlated with a low degree of infectivity.

The outcome of these experiments is considered to support the view that the tobacco mosaic virus is either a simple protein or closely associated with such substances.

Johnson (J.). **An acquired partial immunity to the Tobacco streak disease.**—*Trans. Wis. Acad. Sci. Arts Lett.*, xxx, pp. 27–34, 5 pl., 1937.

In the experiments discussed in this paper approximately 800 potted tobacco plants of various ages, sizes, and degrees of vigour in the greenhouse were artificially inoculated with tobacco streak virus [*R.A.M.*, xv, p. 535; xvi, p. 569] over a period of nine months. All the plants developed typical symptoms of the disease, but after the first attack they all showed a characteristic early recovery, similar to that which occurs in field-infected plants [loc. cit.]. Reinoculation with the tobacco streak virus of 130 of the recovered plants failed in every instance to reproduce in them the necrotic form of the disease, while of the same number of controls, 115 yielded typical streak. The same reactions to the virus were also shown by certain varieties of *Nicotiana tabacum* and by *N. sylvestris* and *N. repanda*, whereas other species yielded mottling only, from which recovery was not evident, and still others chlorotic or very mild symptoms. Preliminary inoculation of tobacco plants with tobacco virus 1, cucumber virus 1, tobacco ring spot, potato ring spot, potato 'mottle', or potato veinbanding failed to protect the hosts against tobacco streak, and conversely the latter failed to give protection against the other viruses tested. The author believes that recovery from tobacco streak is a good example of acquired immunity in plants, and that in the case of some vegetatively propagated crops artificial immunization against certain virus diseases may eventually become a practical control measure.

Braun (A. C.). **Beiträge zur Frage der Toxinbildung durch Pseudomonas tabaci (Wo. et Fo.) Stapp.** [Contributions to the question of toxin formation by *Pseudomonas tabaci* (Wo. & Fo.) Stapp.]—*Zbl. Bakt.*, Abt. 2, xcvii, 9–13, pp. 177–193, 4 figs., 1937.

A tabulated description is given of studies to determine the influence of cultural, biochemical, and physical factors on toxin formation by *Pseudomonas tabaci* [*Bacterium tabacum*: *R.A.M.*, xvii, p. 205], using young bean (*Phaseolus vulgaris*) leaves as test material. The strongest toxic effects were produced by cultures of the organism from a mineral salt solution with potassium nitrate as the source of nitrogen and levulose or saccharose as that of carbon. When the source of nitrogen was varied and glucose given as a source of carbon, the strongest stimulus to toxin production was afforded by gelatine, followed by peptone or tryptophane. With varying carbon nitrogen ratios (glucose: potassium nitrate) toxin formation was most abundant at concentrations of 0·025 to 1 per cent. nitrate and 1 to 2 per cent. glucose. The optimum temperature for toxin production by *Bact. tabacum* was found to be about 25° C., and the process was greatly favoured by a liberal access of oxygen to the cultures, the addition to which of infinitesimal amounts of iron sulphate not only promoted toxin formation in a striking degree, but also counteracted the adverse effects of copper sulphate on the organism. The capacity of *Bact. tabacum* for toxin production was best maintained by weekly subculturing on potato juice agar. Toxin formation is usually, but not invariably, associated with

abundant development in culture, but no definite correlation could be detected between toxin production and the capacity for liquefying gelatine. The toxin of *Bact. tabacum* partially destroys the leaf chlorophyll of tobacco with such rapidity that intermediate products cannot be spectrographically identified.

WINGARD (S. A.) & HENDERSON (R. G.). **Control of Tobacco blue mould (downy mildew).**—*Bull. Va agric. exp. Sta.* 313, 10 pp., 4 figs., 1937.

Following a brief, popular account of the symptoms and etiology of blue mould or downy mildew of tobacco [*Peronospora tabacina*], the writers discuss the control of this disease, which assumed an epidemic form in Virginia in 1937, by cultural methods (including the judicious application of top dressings of nitrate of soda at the rate of 4 to 5 lb. per sq. yd. of seed-bed), spraying, and fumigation. The most satisfactory spray is a mixture of ½ lb. red copper oxide, 1 qt. lethane spreader (Rohm and Haas), ½ gal. cottonseed (also known commercially as Wesson) oil, and sufficient water to make 50 gals. About 2½ gals. of this mixture should cover 100 sq. yds. of a bed containing small plants, but 5 to 7 will be required for larger ones. Eight to 12 applications should be given, at least 3 or 4 being made before infection becomes general. The chief advantage of spraying over benzol fumigation [full directions for which are given: see above, p. 212] is its comparative cheapness ($3 to 4 per 100 sq. yds., excluding the cost of the outfit).

KÜRBIS (W. P.). **Zur Pilzflora der Rhizosphäre der Esche.** [Note on the fungal flora in the rhizosphere of the Ash.]—*Mitt. Forstwirt. Forstwiss.*, viii, 3, pp. 289–292, 1 fig., 2 graphs, 1937.

This is a condensed summary of the results obtained by the author in his studies of the fungi found by him in the rhizosphere of the ash (*Fraxinus excelsior*) from various localities in Germany, a full report of which has already been noticed from another source [*R.A.M.*, xvi, p. 503].

MACDONALD (J. A.) & RUSSELL (J. R.). **Phomopsis scobina (Cke) v. Höhn. and Phomopsis controversa (Sacc.) Trav. on Ash.**—*Trans. bot. Soc. Edinb.*, xxxii, 2, pp. 341–352, 2 pl., 1937.

Phomopsis scobina and *P. controversa* are found on the ash (*Fraxinus excelsior*) in a number of districts in Scotland where they occur either as saprophytes on dead twigs, fruits, and leaves, or as parasites on living tissues, being associated with die-back of the twigs and canker of the stem.

In culture the two species showed considerable differences. *P. scobina* developed a slow growing, tufted mycelium, white at first, but ultimately often developing a pink tinge, and without any black zone lines round the pycnidia. The 'a' spores measured 7 to 13 by 2 to 4 μ, with an average of 10·5 by 3 μ, and the 'b' spores were 16·5 to 25 (average 20·5) by 1 μ. Both types were hyaline. The pycnidia of *P. controversa* showed dark zone lines and contained only 'a' spores which are hyaline and measure 5·5 to 9 by 1·5 to 4 μ, with an average

of 7 by 2·5 μ. It produces a rapidly growing superficial mycelium, which is white and woolly.

When both species were inoculated into plum or apple fruits *P. scobina* caused a slower and drier rot than *P. controversa* and produced numerous pycnidia, whereas *P. controversa* produced none. When inoculated into T-shaped cuts made in the bark of sterilized ash twigs, the mycelium of *P. scobina* penetrated the tissues of the twig, but the mycelium of *P. controversa* grew only on the surface and did not enter into the internal tissues to any great extent. The best method of infecting ash trees was to insert pieces of mycelium from pure cultures into T-shaped cuts in the young bark of twigs of one to three years of age; 72 per cent. (36 out of 50) of such inoculations with *P. scobina* and 48 per cent. (43 out of 90) with *P. controversa* proved successful. Some of the lesions formed by *P. scobina* on the larger branches measured 25 cm. in length, completely encircling them and showing a brown sunken bark with pycnidia freely formed on it. In old infections the bark cracks and drops away. Sometimes the fungus produces a mild witches' broom effect on young twigs of ash. *P. controversa* may occasionally kill smaller twigs, but it forms only small cankers on larger stems and their growth is soon stopped by the formation of a cork barrier. The spread of *P. controversa* appears to be much slower than that of *P. scobina*.

It has been suggested by Grove and others that *P. scobina* is identical with *P. controversa*, but the present authors consider that the existing differences, both in pathogenicity towards ash and in cultural characters, are sufficient to indicate that they are two distinct species.

Van den Broek (M.). **De gomziekte der Amygdaleeën in vergelijking met den boomkanker.** [The gumming disease of the Amygdalaceae in comparison with tree canker.]—*Tijdschr. PlZiekt.*, xliii, 10, pp. 238–248, 1937.

A review is given of some important contributions to the understanding of non-parasitic gummosis of stone fruits [cf. *R.A.M.*, xv, pp. 427, 587, *et passim*], with special reference to the occurrence of the condition in cherries (particularly grafts) in Holland, which is attributed primarily to an excessive accumulation of nutrient salts in the stems and branches consequent on an unbalanced supply of nitrogenous manure. The disorder, like (physiological) apple canker, with which gummosis presents numerous analogies, is most prevalent on heavy, non-permeable soils. Pruning wounds are not, in themselves, a cause of gummosis but the indiscriminate removal of branches may promote its development by disturbing the equilibrium between the root system and the crown, so that the latter cannot properly assimilate the salts derived from the soil. It is obvious that all attempts to combat the disease must be based on the avoidance of the errors in cultivation giving rise to such maladjustments in the metabolism of the trees.

Sprengel (F.). **Ueber die Kropfkrankheit an Eiche, Kiefer und Fichte.** [Note on the 'goitre' disease of Oak, Pine, and Spruce.]—*Mitt. Forstwirt. Forstwiss.*, viii, 3, pp. 340–343, 8 figs., 1937.

The author states that cytological studies of oak, pine, and spruce

wood from trees affected with the 'goitre' condition in Germany [*R.A.M.*, xvi, p. 353] indicated that in all three hosts the disease originates in one or in a very few cells of the cambium, which appear to be of varying thickness and of a shorter length than normal; these cells proliferate abnormally and develop into a 'goitre', while the adjoining cambium remains unaffected. In the oak the affected cambium usually dies in the course of a few years, but in the pine and spruce it usually remains alive much longer. The disease has so far always been observed to originate in the first annual ring of the oak, while in the two conifers it may not appear until much later. The view is again expressed that the disorder may be due to a genetic predisposition of individual trees to react to unknown environmental factors.

CARTWRIGHT (K. T. St. G.). **A reinvestigation into the cause of 'brown Oak', Fistulina hepatica (Huds.) Fr.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 68–83, 7 pl. (2 col.), 6 figs., 1937.

In giving an account of his studies, started in 1933, the results of which showed that 'brown oak' [*R.A.M.*, xvii, p. 148] in the English oak (*Quercus pedunculata* and *Q. sessiflora*) is caused by *Fistulina hepatica* and not by a *Penicillium*, as described by Groom in 1915, the author states that a similar condition in sweet chestnut is also due to the same organism. The fungus was obtained in pure culture from almost all the samples of affected oak and chestnut wood examined, and its pathogenicity to oak was further proved by inserting a plug of 'brown oak' containing *F. hepatica* into an oak branch; eight months later discoloration was found to have occurred in both the sapwood and heartwood of the branch surrounding the inoculum, and mycelium of *F. hepatica* was observed in the wood at a distance of about 5 cm. from the latter. The identity of the fungus was established by comparison with a culture of *F. hepatica* obtained from sporophore tissue. In culture the fungus was shown to grow best at temperatures of 25° to 27° C., and preliminary experiments on its metabolism indicated that it may obtain a portion of its sugar supply from tannin. It is suggested that the brown amorphous material present in 'brown oak' may be a degradation product of the lignin and hemicellulose due to the action of the fungus. A reference is made to the mechanical tests of affected oak wood, the results of which have already been noticed [ibid., xiv, p. 413]. It is considered that 'brown oak' may be safely used where great strength is not required, since there is no risk of further decay in processed wood.

LORENZ (R. C.) & CHRISTENSEN (C. M.). **A survey of forest tree diseases and their relation to stand improvement in the Lake and Central States.**—U.S. Dep. Agric., Bur. Pl. Indus., 63 pp., 11 pl., 1 map, 1937. [Mimeographed.]

This manual gives a semi-popular account of the diseases of forest trees in the Lake and Central States of the United States. The extent of the injury caused by the different diseases is indicated and the conditions which favour their development described. A concluding section deals with forest practices in relation to their effects on disease.

Wilkins (W. H.), Ellis (E. M.), & Harley (J. L.). **The ecology of the larger fungi. I. Constancy and frequency of fungal species in relation to certain vegetation communities, particularly Oak and Beech.**—*Ann. appl. Biol.*, xxiv, 4, pp. 703–732, 1937.

The results of investigations carried out over a five-year period at Haslemere, Surrey, in an attempt to determine the relationship between the fungus flora and certain higher plant associations (communities), with particular reference to oak and beech woods, emphasized the general similarity of the fungus flora in these two types of wood and indicated that the distribution of fungus species, apart from parasites and those growing saprophytically on tree stumps and the like, is dependent on the nature of the substratum, whether humus or leaf litter, the substratum being determined by the nature of the subsoil, the nature and character of the dominant, subdominant, and ground vegetation, and certain climatic factors, such as moisture and temperature. Determinations of the constancy of occurrence of fungal species and of frequency of individuals of the same species are stated to form a convenient method of analysis, and a clear survey and comprehension of the fungal flora of any area can only be arrived at from a summation of the floras of the different ecological units composing that area.

Forest Research in India, 1936–37. Part I. Forest Research Institute.—92 pp., 1937.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xvi, p. 146]. A large number of specimens of sal [*Shorea robusta*] root rot from Bihar and Orissa were examined bearing sporophores belonging to *Polyporus shoreae*, *Fomes tricolor*, and *F. fastuosus*.

The inspection of the roots of various forest trees revealed the presence of mycorrhizal fungi, definite fungal mantles being formed on sal and *Quercus incana* roots.

Inoculation experiments on *Pinus excelsa* and *Cedrus deodara* with *Trametes pini* and *F. annosus*, respectively, gave positive results.

A repetition of previous experiments confirmed the genetic relationships between *Peridermium orientale* (*P. complanatum*) on *Pinus longifolia* and *Coleosporium campanulae* on *Campanula colorata* and *C. canescens*; *Peridermium brevius* on *Pinus excelsa* and a new *Coleosporium* on *Senecio rufinervis*; *Peridermium piceae* on *Picea morinda* and *Chrysomyxa himalayensis* on *Rhododendron arboreum*; *Peridermium ephedrae* on *Ephedra vulgaris* and a new *Hyalopsora* on *Althyrium acrosticoides*; and *P. abies-pindroina* n.sp. [without a diagnosis] and a new *Uredinopsis* on *Polypodium* sp.

Details are given of new installations of ascu wood preservation [see above, p. 216] pressure plants and of further experiments in this method of impregnation.

Eradication of the Dutch Elm disease.—*Science*, N.S., lxxxvi, 2239, p. 485, 1937.

During the summer of 1937 the activities of the U.S. Federal forces engaged in the campaign against the Dutch elm disease [*Ceratostomella ulmi*: *R.A.M.*, xvii, p. 143] are estimated to have reduced the number of infected trees 25 per cent. below the previous year's figures in the

extensively invaded area extending 50 miles radially from New York City into Connecticut, New York State, and New Jersey. Only two new foci of infection were detected in 1937, in Ohio and West Virginia, and the diseased trees (six in all) were destroyed. New infections along the boundaries of the major zone of the disease were limited to isolated trees. There was, however, an increase of infections at Indianopolis, Indiana, where *C. ulmi* has been present since 1934, the fungus having been proved by laboratory cultures of twigs to occur in 31 trees. An autogyro observer inspected 11,000 miles of railroad rights of way, over which the imported logs introducing the disease into the United States were conveyed inland for cabinet-making purposes, and a follow-up ground crew visited points marked on his map.

RADULESCU (T.). **Beiträge zur Kenntnis der Baumkrankheiten. I. Teil. Untersuchungen über den Blasenrost der Weymouthskiefer. II. Teil. Versuche über das Ulmensterben. III. Teil. Das Verhalten eines Blaufäulepilzes in lebendem und in totem Holz.** [Contributions to the knowledge of tree diseases. Part I. Investigations on the blister rust of the Weymouth Pine. Part II. Experiments on the Elm die-back. Part III. The behaviour of a blue rot fungus in living and in dead wood.]—*Forstwiss. Zbl.*, lix, 19, pp. 597–609; 20, pp. 629–643; 21, pp. 677–683, 4 figs., 3 diags., 2 graphs, 1937.

With a view to determining the silvicultural importance of blister rust [*Cronartium ribicola*] of the Weymouth [white] pine [*Pinus strobus*] in Germany [*R.A.M.*, xvi, p. 219], the writer investigated the position in several Upper Bavarian forests. In a 52-year-old stand covering an area of 0·14 hect. 25 out of 73 felled trees were diseased (34 per cent.), 16 (22 per cent.) showing stem cankers, mostly from 7 to 20 years old, though reaching an age of 30 years or more in four of the trees without producing any apparent injury to their health. An examination of transverse sections of felled stems showed that the trees are able to withstand invasion by blister rust for 50 years or so, since cambial necrosis does not begin until 9 to 16 years (average 12) after infection; it then proceeds about three times (2 to 5 cm. per annum) as rapidly, however, as in the case of *Peridermium pini* [see above, p. 214] on *Pinus sylvestris*, trees attacked by which may survive for a century. Constitutional differences appear to play an important part in the reaction of *P. strobus* to blister rust, which has been found heavily infecting certain trees while sparing others in the immediate vicinity.

Summing up the results of his observations, the writer upholds the verdict of the white pine commission (Verlag Reichsnährstand, Abt. 'Der Deutsche Forstwirt', 1935) to the effect that a temporary suspension of cultivation of *P. strobus*, as recommended by Tubeuf [*R.A.M.*, xiv, p. 541 *et passim*] is not required on the basis of the present blister rust situation, though his insistence on stringent quarantine regulations and elimination of infected material is fully justified.

In laboratory and field experiments, conidial suspensions of *Ceratostomella ulmi* [see preceding abstract] were carried by the transpiration stream into the tracheae of elm (*Ulmus montana*), oak, ash, hornbeam [*Carpinus betulus*], and beech leaves, and conveyed through the opened veins into the conducting channels of the branches; the conidia did

not long remain viable, however, in the vessels of *U. montana*, none surviving 20 to 24 days. Vascular discolorations developed in *U. montana* and oak absorbing conidia through the water stream, but no tyloses were formed in elms treated with a fungal filtrate. Infection by *C. ulmi* may, under certain conditions not fully understood, lead to sickliness of the entire tree without any accompanying vascular discoloration, which is not a necessary feature of the disease.

The lower limit of the water content of Scots pine (*P. sylvestris*) sap wood permitting growth of the blue stain fungus, *Ceratostomella* [or *Grosmannia*] *pini* [ibid., xv, p. 827] was experimentally found to be 35 per cent., with an optimum at 38 to 65 per cent. and an upper limit of 150 per cent. Somewhat better growth was made in living than in dead wood with a water content of up to 115 per cent., beyond which point the position is reversed. It would thus appear that *C. pini* prefers living to dead wood as a substratum.

In a few tests carried out on white pine (*P. strobus*), *C. pini* penetrated the loose, broad-ringed wood of this species more deeply and rapidly, especially at a water content of 65 per cent. and upwards, than that of *P. sylvestris* with its denser texture. The pith was more extensively involved than the xylem. In the case of dead white pine material, substances deleterious to the fungus inhibit its normal production of sclerotial columns, perithecia, and conidiophores between the inner bark and the xylem.

The significance of these observations in relation to contemporary studies on the factors influencing the development of lignicolous fungi is briefly discussed.

Goidànich (G.). **Le alterazioni del legno da parassiti cromogeni.** [Changes in wood due to staining parasites.]—Reprinted from *Ital. agric.*, lxxiv, 8, 14 pp., 1 col. pl., 8 figs., 1937.

This is an abridged version of the writer's studies on the staining of coniferous wood by fungal parasites in Italy, a fuller account of which has been noticed from another source [*R.A.M.*, xvi, p. 578].

Rohde (T.). **Ueber die 'Schweizer' Douglasienschütte und ihren vermuteten Erreger Adelopus spec.** [On the 'Swiss' needle-fall of Douglas Firs and its supposed agent *Adelopus* sp.]—Reprinted from *Mitt. Forstwirt. Forstwiss.*, viii, 28 pp., 2 col. pl., 25 figs., 2 graphs, 1937.

This is a comprehensive survey of the contributions [already noticed here] made by the writer and others to the knowledge of the needle-fall of Douglas firs (*Pseudotsuga taxifolia*) caused by *Adelopus gäumanni* in Switzerland and Germany [*R.A.M.*, xvii, p. 85].

Lepik (E.). **Männiroosteist ja-koorepõletikest.** [Pine rusts and their distribution.]—*Eesti metsand. Aastar.*, viii, pp. 177–196, 4 figs., 1 map, 1937. [English summary.]

From his study of the herbarium material of Estonian pine rusts at the Phytopathological Experiment Station of Dorpat University the author concludes that *Cronartium ribicola* is, without doubt, of Asiatic origin, its original host being *Pinus cembra*. This comparatively

resistant tree, however, did not materially contribute to the spread of of the rust, which only assumed a formidable character after its introduction into Europe from America on *P. strobus* in 1705. The first observation on its occurrence in Europe was made in Estonia in 1854 by H. A. Dietrich on currant, and he named the fungus *C. ribicola* without a diagnosis, thereby forfeiting his claim to priority as its author, a distinction reserved for Fischer (1872). The same rust was also discovered by Dietrich on white pine and named *Peridermium pini* f. *corticola* [*R.A.M.*, xv, p. 619] in ignorance of its identity with *C. ribicola.* In addition to North America the white pine blister rust has invaded Japan and Saghalien Island, so that its distribution in the northern hemisphere may be termed general. Under Estonian conditions afforestation with white pine cannot be contemplated on account of the ravages of *C. ribicola,* which necessitates the annual eradication of infected individuals from parks and avenues in order to save the currant crops. Besides black, white, and red currants and gooseberries the rust attacks *Ribes alpinum*, *R. aureum*, *R. palmatum*, and *R. succirubrum* in various localities.

Alternate hosts of *C. flaccidum* (*C. asclepiadeum*) [ibid., xvii, p. 87] on *Pinus sylvestris* (as *Peridermium pini*) have been found to include several species of peony, *Vincetoxicum officinale* and *V. rehmanni*, *Verbena teucrioides*, and *Tropaeolum canariense. Pinus laricio* [*P. nigra*] var. *austriaca*, *P. montana*, and *P. sylvestris* are all liable to infection by *Coleosporium senecionis*, seven other species of which are also listed. *Melampsora pinitorqua* [see above, p. 214] occurs on poplars (*Populus alba*, *P. tremula*, and *P. canadensis*).

Jump (J. A.). **Further notes on the disease of Himalayan Pines.**—*Bull. Morris Arbor. Univ. Pa*, i. 7, pp. 97–98, 1937.

During the exceptionally severe winter of 1933–4, Himalayan pines (*Pinus excelsa*) in Pennsylvania and New Jersey were seriously damaged by cankers due to *Sphaeropsis malorum* [*Physalospora obtusa*: *R.A.M.*, xvii, p. 46], which was isolated in pure culture and inoculated into three-year-old pine and young apple trees with positive results. It was evident from a study of the annual growth rings in dead *Pinus excelsa* trees that the old suberized cankers had originated in winters when unusually low temperatures prevailed and apparently created conditions favouring infection by *Physalospora obtusa.*

Wilde (S. A.). **Recent findings pertaining to the use of sulfuric acid for the control of damping-off disease.**—*J. For.*, xxxv, 12, pp. 1106–1110, 1937.

The results of field experiments in the control of damping-off [*Pythium* and *Rhizoctonia*: *R.A.M.*, ix, p. 8] in conifers in Wisconsin forest nurseries indicated that 2 per cent. is the maximum concentration of sulphuric acid, applied at the rate of 7 gals. per sq. ft., required for this purpose on non-calcareous sandy soils. Where the disease occurs in a mild form a reduction of strength to 1·5 per cent. may be feasible for autumn applications, and is advisable in any case for the treatment of spring-sown beds owing to the risk of chemical injury to the seedlings at this season. The sulphuric acid treatment is not suitable for

calcareous soils, which rapidly regain their original alkaline reaction after watering, and should be replaced by formaldehyde or some other method. Siliceous sand also tends to revert quickly to neutrality, but granitic sand maintains a sufficiently acid reaction.

ZYCHA (H.). **Über das Wachstum zweier holzzerstörender Pilze und ihr Verhältnis zur Kohlensäure.** [On the growth of two wood-destroying fungi and their relation to carbon dioxide.]—*Zbl. Bakt.*, Abt. 2, cxvii, 9–13, pp. 223–244, 2 figs., 2 diags., 8 graphs, 1937.

Comparative physiological studies on two wood-destroying fungi, the saprophyte *Coniophora cerebella* [*C. puteana*: see above p. 215] and the parasite *Polyporus* [*Fomes*] *annosus*, the agent of spruce red rot [*R.A.M.*, xvii, p. 86], revealed a far-reaching similarity. The fungi were cultured in flasks on malt solution, taking mycelial dry weight as a criterion of growth. The development of the organisms was stimulated by the addition of calcium carbonate to the medium, increasing concentrations of which up to 8 per cent. resulted in a proportionate augmentation of yield. *C. puteana* responds to light by increased growth, whereas *F. annosus* is indifferent. Both fungi are copious acid-formers. Carbon dioxide formation per gm. of mycelium amounts to 1 to 2 c.c. per hour in the case of *C. puteana* and to 2 to 3 c.c. in that of *F. annosus*, the apparently lower production of the former being due to its incomplete consumption of nutrients, since it actually forms more acid than *F. annosus*. With the aid of a special contrivance for the passage of gas through a series of flasks, the influence of a constant atmospheric content of carbon dioxide on the growth of the two fungi was investigated and found to be just as powerful in the case of the superficial *C. puteana* as in that of *F. annosus*, an occupant of the soil or of the internal tissues of spruce stems. The inhibition of growth was almost proportional to the carbon dioxide content of the surrounding air, and growth apparently ceased at 60 per cent., although death did not ensue at this concentration even after several days.

GISTL (R.). **Zur Kenntnis des 'echten Hausschwammes'.** [A contribution to the knowledge of the 'true dry rot fungus'.]—*NachrBl. dtsch. PflSchDienst*, xii, 4, pp. 225–233, 5 figs., 1 graph, 1937. [English, French, and Spanish summaries on pp. 345, 347–348, 350.]

The salient features of the author's study at the Munich Technical Institute on the physiology of the dry rot fungus (*Merulius lacrymans*) have already been noticed from another source [*R.A.M.*, xv, p. 695].

FINDLAY (W. P. K.). **Testing wood preservatives in the laboratory.**—*Pap. Brit. Wood Pres. Ass., 1935–6*, pp. 10–16, 1937.

A concise description is given of the methods employed at the Forest Products Research Laboratory, Princes Risborough, in the testing of wood preservatives in the laboratory [cf. above, p. 261].

RICHARDSON (N. A.). **Wood preservatives.**—*J. Soc. chem. Ind., Lond.*, lvi, 52, pp. 1148–1152, 1937.

Much of the information presented in this concise but comprehensive

survey of modern developments in timber preservation in England, especially in relation to wood-destroying fungi, has already been noticed here from other sources, but mention may be made of the following items. Magnesium silicofluoride is frequently recommended for the prevention of dry rot [*Merulius lacrymans*], but care should be taken to avoid contact with metal or glass, to which the compound is injurious. A special apparatus in use at the Forest Products Research Laboratory in connexion with the testing of preservatives by the wood block method [*R.A.M.*, xv, p. 546; xvi, p. 76] consists of a modified Soxhlet extractor for leaching-out trials. The use of this apparatus obviates the main objection to the common method of shaking the treated sample for a given number of times in a container with a fixed volume of cold water, viz., that the water becomes more or less saturated with the preservative salts, especially those of low solubility, so that the subsequent analytical data are apt to show the disinfectant in an unduly favourable light.

Osmose wood preservation.—*For. Chron.*, xiii, 4, pp. 506–508, 1937.

Excellent results are stated to have been obtained by the application of the so-called 'osmose' preservatives [*R.A.M.*, xv, p. 546] to spruce and balsam fir logs in the Laurentide Limit of the Anglo-Canadian Pulp & Paper Mills, Ltd. The substances used are supplied to the trade under the name of 'osmotite', which consists of dinitrophenol, sodium fluoride, and potassium bichromate in powder form, and is mixed in the field with 50 per cent. water. The logs were given a full-length treatment with a brush and covered with osmose waterproof paper for about eight weeks, after which they were examined for depth of penetration of the preservatives by means of the standard alizarin colour reagents. The depths of penetration were as follows: dinitrophenol in 5 in. spruce and $7\frac{3}{4}$ in. balsam fir logs, $\frac{5}{8}$ in. in both cases; sodium fluoride, $2\frac{1}{8}$ and 3 in., respectively. The treated wood has a clean, dry, odourless surface.

Ramsbottom (J.). **Dry rot in ships.**—*Essex Nat.*, xxv, 5, pp. 231–267, 1937.

An interesting account, amplified by numerous quotations from historical records and correspondence, is given of the ravages caused among the wooden vessels of the British Navy by dry rot (*Merulius lacrymans*, *Coniophora puteana*, and other fungi) from the earliest times until the introduction of ironclads in 1863.

Becker. **Kohlrüben-Fäulnis.** [Swede rot.]—*Dtsch. landw. Pr.*, lxiv, 48, p. 588, 1937.

A popular note is given on the occurrence of club root of swedes [*Plasmodiophora brassicae*] in the Eutin district [Oldenburg: *R.A.M.*, v, p. 529], where losses of up to 50 per cent. of the crop may be caused by the disease, which is sometimes so destructive as to necessitate the total abandonment of swedes in favour of beets. Livestock may be safely fed on diseased swedes, but care should be taken not to use contaminated manure on swede fields. The incidence of *P. brassicae*

is increased by the use of liquid manure, whereas calcium cyanamide [*R.A.M.*, xv, p. 335] reduces it.

CHITTENDEN (E.) & COOP (L. G. L.). **The use of borax in the control of brown-heart of Turnips.**—*N.Z. J. Sci. Tech.*, xix, 6, pp. 372–376, 2 figs., 1937.

Further experiments confirmed the highly beneficial effects of borax in the control of brown heart of Green Globe turnips in the Nelson district of New Zealand [*R.A.M.*, xvii, p. 152]. The best results were obtained by the use of 20 lb. borax per acre top-dressed over the land prior to sowing the seed, or by mixtures of ground limestone, superphosphate, and 10 lb. borax per acre sown with the seed in 14 in. drills. Even at the rate of 10 lb. per acre borax caused serious mortality of young turnips when mixed with superphosphate and the seed.

GOIDÀNICH (G.). **Sulle specie di Alternaria che producono il nerume del Cavolfiore in Italia.** [On the species of *Alternaria* which produce Cauliflower black spot in Italy.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 2, pp. 193–200, 1 fig., 1937.

During 1936–7 cauliflowers growing in the province of Pisa showed about 15 per cent. infection by black spot [*R.A.M.*, xv, p. 70], the disease first appearing in November or December, reaching a maximum in January or February, and virtually disappearing in March.

Isolations from lesions on the inflorescences yielded an *Alternaria* with spores averaging 130 to 229 by 15 to 24 μ, identified as *A. brassicae* (Berk.) Bolle. *A. brassicae* (Berk.) Sacc. listed by Bolle as a synonym of *A. circinans* also causes the disease in Italy, both fungi sometimes occurring on the same plant.

Other forms of *Alternaria*, probably saprophytic, were also isolated from the affected material.

THIEDE. **Zur Blattfleckenkrankheit und Schosserbildung bei Zuckerrüben. Beobachtungen an diesjährigen Zuckerrüben.** [On the leaf spot disease and 'bolter' formation in Sugar Beets. Observations on the current year's Sugar Beets.]—*Dtsch. landw. Pr.*, lxiv, 48, p. 588, 3 figs., 1937.

Leaf spot of sugar beets (*Cercospora beticola*) was more prevalent in some parts of Germany [see above, p. 220], especially the Altmark, in the autumn of 1937 than for some time past. The leaf yields of affected plants are substantially reduced, amounting in some cases to only a third of the normal, and moreover the foliage has to be acidified before use as fodder, since in the fresh state it is rejected by livestock. The beet production of affected stands falls more or less according to the time of onset of the disease, and factory percentages show that the sugar content fell to 16 or 17 per cent. During the period of these observations infection began early in September, spread rapidly in the warm, damp weather (mean maximum temperature 21·9° C.), and reached a climax at the end of the month. The selected E sugar-beet strains were found to be particularly susceptible to leaf spot, but the bearing of cultural factors, such as soil constitution and manuring, on the disease is obscure.

FOURMONT (P.). **De l'utilisation du formol pour la désinfection des semences de Betteraves.** [On the use of formalin for the disinfection of Beet seed.]—*C.R. Acad. Agric. Fr.*, xxiii, 31, pp. 981–984, 1937.

Good results were obtained in a limited series of tests at the Versailles Phytopathological Station in the control of *Phoma betae* on beet seed-clusters [see above, p. 220] by disinfection with formalin, but great care must be taken not to exceed certain well-defined limits (1, 0·5, 0·5, and 0·35 per cent., respectively, for varieties herein designated A, B, J, and R). The treatment resulted in an increase of germination over the controls amounting to 22, 45, and 10 per cent., respectively, in A, J, and R, whereas in the case of B a reduction of 9 per cent. resulted.

SCHMIDT (E. W.). **Der parasitäre Pflanzenkrebs und der Rübentumor.** [Parasitic crown gall and the Beet tumour.]—*Dtsch. Zuckerindustr.*, lxii, 51, pp. 1133–1134, 6 figs., 1937.

The examination of German beet material infected by crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, x, p. 285] revealed a higher albumin and lower sugar content in the diseased than in the healthy tissues, nitrate nitrogen was more abundant in the latter, while tyrosinase and catalase occurred in greater profusion in the former.

SCHMIDT (E. W.). **Untersuchungen über die Ursache der Herz- und Trockenfäule der Rüben und die Bedeutung des Bors.** [Investigations on the cause of the heart and dry rot of Beets and the significance of boron.]—*Z. WirtschGr. Zuckerindustr.*, lxxxvii, 11, pp. 679–700, 8 figs., 1937.

Analyses of the nitrate-nitrogen content of diseased (heart and root rot) and healthy sugar beets in water cultures with and without boron (1·5 mg. per pot as borax) revealed an excess of nitrate-nitrogen in all organs of the plants deprived of the trace element [*R.A.M.*, xvii, p. 89]. Abnormally thick and very brittle leaves were produced by diseased beet seedlings. Beets in nitrogen-deficient sand cultures did not contract heart and root rot even in the absence of boron. Beet plants supplied with boron wilted more slowly and withdrew less nitrate from the soil solution than those deprived of this element. The cotyledons of beet seedlings receiving boron contained less calcium oxalate than those unprovided with this element. The application of sodium nitrate to a soil with a tendency to heart and root rot caused an increase of disease from 8·4 to 26·1 and from 5·2 to 26·5 per cent. in 1936 and 1937, respectively.

SCHMIDT (E. W.). **Über den Einfluss des Bors auf den Nitratstoffwechsel.** [On the influence of boron on nitrate metabolism.]—*Ber. dtsch. bot. Ges.*, lv, 7, pp. 356–361, 1937.

Details are given of the writer's analytical studies at the Kleinwanzleben Research Institute on the influence of boron on the nitrate metabolism of sugar beets, barley, and oats in sandy soil [see preceding abstract]. Applied to experimental plants in doses corresponding with the usual agricultural practice, boron caused disturbance in the nitrate metabolism of a definitely toxic character.

Schropp (W.) & Scharrer (K.). **Untersuchungen über die Wirkung des Bors bei verschiedener Wasserversorgung.** [Investigations on the action of boron with varying water supply.]—*Bodenk. u. Pfl-Ernähr.*, N.F., l, 5–6, pp. 289–303, 1937.

A detailed description is given of the writer's pot experiments to determine the effects of boron on the growth of Eckendorf fodder beets in three different soil mixtures of varying reaction (P_H 7·16, 6·60, and 6·09) and water-holding capacities. Three grades of watering were employed—scanty, normal, and plentiful.

Heart and dry rot [*R.A.M.*, xv, p. 476, and preceding abstract] in all watering grades was more prevalent in the slightly and very slightly acid soils than in the alkaline series. Of much greater importance than the soil reaction in the prevention of the disease was a plentiful water supply, which also contributed to an increased yield except in naturally moist soils.

Boron (10 mg. per pot as boric acid) was uniformly helpful in the control of heart and dry rot and also slightly increased the yields of plants deprived of water in the absence of disease. The relative nitrogen content of healthy beet roots was generally lower than that of the leaves, whereas in particularly severe cases of heart and dry rot a reverse relation obtained. The addition of boron to the alkaline soil, combined with an increasing water supply, augmented the nitrogen content of roots and leaves; on soils with a heavy incidence of disease the trace element mostly lowered the nitrogen content of the root and raised that of the foliage in relation to the controls.

Hull (R.). **Effect of environmental conditions, and more particularly of soil moisture upon the emergence of Peas.**—*Ann. appl. Biol.*, xxiv, 4, pp. 681–689, 2 graphs, 1937.

The results of experiments during the winter and spring of 1933–4 and the spring of 1935 at Slough and in Cheshire with Pilot, Alaska, and Gradus peas showed that high soil moisture considerably reduced the emergence of seedlings, soil temperature being of less importance, and that Gradus with wrinkled seeds was more liable to fail in emergence than the other varieties, both with smooth seeds. Collateral pot experiments indicated that the reduction in stand is chiefly due to the activity of soil-borne organisms; high mortality of pea seeds and seedlings was experimentally shown to be caused under conditions of high soil moisture by a species of *Fusarium* and an unidentified Phycomycete, both of which were isolated from diseased seedlings, the last-named being distinctly the more active parasite under laboratory conditions. Material improvement in stands was obtained by dusting the dry seeds with a proprietary organic mercury compound. The growth of the aerial organs was not visibly affected by the maximum load of the preparation which the dry pea seed is able to carry, but the tap-roots of the seedlings were appreciably stunted in their development.

Botany and plant pathology.—*Rep. Ala. agric. Exp. Sta., 1936*, pp. 24–25, 1937. [Received January, 1938.]

The following item, contributed by J. L. Seal, is of interest in this

report. *Ascochyta pinodella* predominated as an agent of disease among winter peas and vetches [*Vicia* spp.] during 1936 in Alabama [*R.A.M.*, xiv, p. 428], though *A. pisi* and *Mycosphaerella pinodes* were also found in field plantings of winter peas, and the latter was further common in autumn canning pea plantings, frequently in the perfect stage. The organisms are carried in and on the seed, and so far no method of treatment has been devised to destroy them without injuring the seed. The fungi are also perpetuated from year to year in the soil, so that the development of resistant pea strains would appear to constitute the sole measure of control.

WEI (C. T.). **Rust resistance in the Garden Bean.**—*Phytopathology*, xxvii, 11, pp. 1090–1105, 1 fig., 1937.

Five major types of bean (*Phaseolus vulgaris*) rust (*Uromyces appendiculatus*, recently designated by Arthur *U. phaseoli typica*) are differentiated, based on the one hand on the extent of necrosis and on the other on the amount of sporulation developing in 50 varieties as a sequel to inoculation with a culture of the fungus from S. A. Wingard maintained on the susceptible Kentucky Wonder [*R.A.M.*, xiii, p. 205], viz., 0, 1, 2, 3, and 4 in descending order of resistance. Types 0 (subdivided into 0o (characteristic of Lazy Wife), 0a, and 0b (of Early Rogers, Refugee, Early Stringless Refugee, Hodson Wax, Idaho Refugee (in part), Stringless Refugee Wax, Wisconsin Refugee, and Scarlet Runner (*P. multiflorus*)), 1 (1a and 1b), and 2 are considered to be resistant, 3 and 4 susceptible, while plants showing symptoms partaking of the nature of both groups are intermediate and designated as X (Xa and Xb).

The reaction types do not fluctuate within a temperature range of 16° to 28° C., except that type 3 infection on the X group is proportionally increased both by high and low temperatures, the latter also prolonging the incubation period. Light is essential for the penetration of the fungus, a reduction of intensity prolonging the incubation period and, beyond a certain point, inducing necrosis in type 4 infection, besides increasing the proportion of type 3 infection in the X group.

Excess nitrogen augments the incidence of rust per unit area of the leaf and vice versa, whereas potassium exerts a diametrically opposite action. A low nitrogen : potassium ratio increases type 3 infection on the mesothetic (intermediate) varieties. The amount and type of infection were not influenced (except in one instance) by the addition of boron, lithium, zinc, or germanium to the standard nutrient solution unless the concentration was high enough to cause abnormal growth. Senescence of the host tissue tends to reduce the incidence of infection, but does not materially affect the type, except that the proportion of type 3 on the mesothetic hosts progressively increases and finally supersedes the other two types of infection. The nature of this protoplasmic resistance appears to be dual, resulting from a combined action of host and pathogen, the death of the former presumably being due to the action of toxins produced by the rust, and that of the latter to antibodies formed by the plant.

GOIDÀNICH (G.). **Notizie su una malattia della Vite poco conosciuta.** [Notes on a little known Vine disease.]—*R.C. Accad. Lincei*, xxvi, 3–4, pp. 107–112, 3 figs., 1937.

The fungus isolated from the elongated, rather narrow cankers situated chiefly on the lower internodes of necrotic vine stems (an unspecified white variety grafted on Kober 5 BB) near Trieste, Italy, was found to possess two kinds of pycnospores—one oval, basally pointed, 6 to 10·1 by 2·4 to 3 μ, the other (scolecospore) elongated, tapering towards both ends, hyaline, curved or flexuous, 18 to 23 by 1 to 1·5 μ. It is thus evidently a species of *Phomopsis* and may well be closely related to *P. cordifolia* (Brunn.) Died., reported as a vine parasite from Germany. It is still more nearly allied, however, to the imperfect stage of *Cryptosporella viticola*, the causal organism of 'dead arm' of vines in the United States, Japan [*R.A.M.*, iv, p. 650, and possibly Holland: ibid., xvi, p. 299]. Reddick misinterpreted the scolecospores of the pycnidial stage of *C. viticola* as paraphyses and named the fungus *Fusicoccum viticolum* in *Bull. N.Y. St. agric. Exp. Sta.* 389, 1914, which the author transfers to *Phomopsis* as *P. viticola* (Redd.) G. Goid. n. comb.

BITANCOURT (A. A.). **A organisação da defesa sanitaria vegetal na Republica Argentina.** [The organization of the sanitary protection of plants in the Argentine Republic.]—*Biologico*, iii, 10, pp. 289–297, 4 figs., 1 diag., 1937.

Most of the information given in this paper has already been noted from another source [*R.A.M.*, xv, p. 272]. The Department of Agricultural Protection, complementary to the Department of Plant Health but working independently of it, is stated to be responsible for the elaboration and application of measures for the control of pests and diseases.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xi, 11, pp. 249–250, 253–254, 1937.

ECUADOR. A Decree of 1st July, 1937, endorsing the phytosanitary agreement between Ecuador and Chile of 9th January, 1937, provides that avocados imported into Chile from Ecuador must emanate from regions free from anthracnose (*Physalospora perseae*) [*R.A.M.*, ix, p. 63] or in which the disease has been practically eliminated by continuous systematic control.

VENEZUELA. The presence of witches' broom of cacao (*Marasmius perniciosus*) having been notified in Sucre State and Federal Territory Delta Amacuro, Venezuela, measures are prescribed by Resolutions Nos. 6, 7, and 8 of 15th June, 1937, to prevent the spread of the disease to non-infected zones by (*a*) the prohibition of transport from infected areas of cacao plants or parts thereof, pods or beans, earth, sacks, or packing-cases utilized for cacao; (*b*) the disinfection of ships after transporting cacao from infected zones before leaving for other regions of the country; and (*c*) the exclusion from the country of any cacao plant, fruit, seed, or other part of whatever origin, of sacks or other material previously utilized for the packing of cacao, and of soil, irrespective of the place of origin.

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BOSHART (K.). **Ueber Stickstoffdüngung im Gemüsebau.** [On nitrogenous manuring in vegetable cultivation.]—*Obst- u. Gemüseb.*, lxxxiii, 12, pp. 166–169, 3 figs., 1937.

In connexion with an experimental study conducted concurrently in the Munich district and other parts of Bavaria of the properties of nitrogen as a fertilizer for different vegetables, the writer mentions the valuable effects of this element in all the forms tested—ammonium chloride, ammonium sulphate, sodium nitrate, Leuna nitrate, urea, and calcium cyanamide—in combating leaf spot of celery (*Septoria apii*) [*R.A.M.*, xv, p. 275].

SCHULTZ (H.). **Zur Biologie der Bremia lactucae Regel, des Erregers des falschen Mehltaus des Salats.** [Contribution to the biology of *Bremia lactucae* Regel, the agent of downy mildew of Lettuce.]—*Phytopath. Z.*, x, 5, pp. 490–503, 7 figs., 3 graphs, 1937.

Five- to sixty-day-old sporangia of *Bremia lactucae*, the agent of downy mildew of lettuce in Germany and other European countries, germinate at a temperature range of 1° to 19° C., with an optimum at 10°, the corresponding figure for the same organs when one day old being 1° to 2°. They are fairly resistant to atmospheric desiccation, germinating to the extent of 18 per cent. after 16 hours in air maintained at 16 per cent. relative humidity. The sporangia germinate more freely and hyphal development is more rapid on lettuce leaves than in pure water. Infection takes place by means of stomatal penetration by the germ-tubes, the optimum temperature for this process being 15° to 17° in an atmosphere saturated with moisture for at least five to seven hours. The mycelium spreads intercellularly through the host tissues, the hyphae sending numerous haustoria into the cells. The fructification of the fungus takes place in a moisture-saturated atmosphere at 15° to 17° eight to nine days after infection, the incubation period being one or two days longer in the Maikönig variety than in Kaiser Treib. The control of downy mildew should be based in the first instance on the avoidance of the excessively damp conditions promoting the rapid and abundant development of the fungus.

Brown (J. G.). **Relation of livestock to the control of sclerotinosis of Lettuce.**—*Phytopathology*, xxvii, 11, pp. 1045–1050, 1 fig., 1937.

Livestock may prove either harmful or beneficial in relation to the control of *Sclerotinia sclerotiorum* on lettuce in Arizona [*R.A.M.*, xvi, p. 13], according to the manner of feeding. Farm animals, fed on infected lettuce refuse in corrals and farmyards, aid in the dissemination of the disease, whereas an appreciable degree of control may be effected by the pasturage of stock, especially sheep, on infected plants after harvest, and by quarantining the animals for four days, the maximum period for the evacuation of the living sclerotia. Sheep digested from 95 to 99·5 per cent. of the sclerotia eaten, and evacuated in a whole condition an average of 1·6 per cent. of which less than 1 per cent. were capable of growth.

Luyet's vital stain gave excellent results in the determination of sclerotial viability in *S. sclerotiorum*.

Cook (H. T.). **Watermelon wilt and resistant varieties for its control.**—*Bull. Va Truck Exp. Sta.* 97, pp. 1513–1526, 11 figs., 1937.

A description is given of the symptoms of watermelon wilt (*Fusarium bulbigenum* var. *niveum*) which has been reported in Virginia [*R.A.M.*, xvi, p. 85] since 1918, but suddenly became destructive in 1933, and has since spread with great rapidity in the State. The fungus prefers high temperatures (75° to 90° F.) but will grow at from 47° to 95°, temperatures of 61° to 65° being especially conducive to seedling decay. Abundance of organic matter in the soil favours the survival of the fungus which has been known to persist for 16 years in the absence of its host crop. Tests conducted during the last four years have shown that various wilt-resistant varieties are satisfactory for use in Virginia. Of these the Hawkesbury Wilt Resistant (developed in New South Wales) [see below, p. 298], Leesburg, and Wilt Resistant Klondike are the most promising, and their characteristics are briefly described.

Reyes (G. M.). **Sclerotium wilt of Peanut, with special reference to varietal resistance.**—*Philipp. J. Agric.*, viii, 3, pp. 245–287, 22 pl., 5 figs., 1937.

Wilt disease of the groundnut due to *Sclerotium rolfsii* [*R.A.M.*, xv, p. 325] is stated to cause considerable injury in the Philippines, where the fungus attacks the stems and crown roots near ground-level, causing the stem to shrink and die and the foliage to wilt. The underground parts may also be affected, resulting in the rotting of the gynophores, pods, and roots. Infection is most severe during the wet season. The pathogenicity of *S. rolfsii* was established by inoculation experiments; infection of the young plant usually results in death, while plants infected at maturity give a greatly reduced yield. The fungus was observed attacking cassava, cowpea, and mango in the Philippines for the first time, while the total hosts affected number 54. In experiments on varietal susceptibility, from 31·3 to 50·7 per cent. of the plants were wilted. The most resistant varieties were the late maturing Virginia Jumbo (a), Virginia Jumbo, and Tai-tau (all of which the author recommends also as heavy yielders and producing large kernels with good dormancy quality), followed by Tirik, Vigan Lupog, San

José No. 3, Cagayan No. 1, Biit, Spanish, White Improved Spanish, Georgia Red, Macapno, and Valencia. Although no consistent results have been obtained, yet a definite relation between the number of diseased and germinated pods to infection has been observed. Runner types are more resistant than the erect or semi-erect varieties, and it may be possible to breed hybrids possessing desirable crop characters combined with disease resistance.

Morquer (R.). **Études biologiques sur les associations fongiques. Coexistence de champignons viticoles sur le même hôte. Hypocréacées.** [Biological studies on fungal associations. Coexistence of viticolous fungi on the same host. Hypocreaceae.]—*Rev. gén. Bot.*, xlix, 585, pp. 558–594; 586, pp. 619–636, 24 figs., 1937.

In the second part of this paper the author gives a detailed description of his studies in pure culture of two fungi isolated by him from diseased vine branches from Bulgaria, which were sent to him by L. Rives in 1932. One of these organisms is considered to be new to science and is named *Acrostalagmus ampelinus* [without a Latin diagnosis], and the other is identified as a biological form of *Fusarium vasinfectum*. The pathogenicity of these two fungi has not been tested.

Vidal (J.-L.). **Suites d'expériences contre la chlorose.** [Further experiments on the control of chlorosis.]—*Rev. Vitic., Paris*, lxxxvii, 2263, pp. 370–371, 1937.

In continuation of his studies on the control of vine chlorosis [*R.A.M.*, xvi, p. 366] the author gives tabulated data on the effect of ten different treatments on the yield of originally affected stocks in 1936 and 1937. The highest yield for the two years together was obtained from plots treated in 1935 and 1936 with iron sulphate (25 per cent.) and citric acid (6 per cent.), and that for 1937 from vine stocks swabbed in 1935 with iron nitrate (20 per cent.) and with the iron sulphate and citric acid mixture in 1936. These results confirm the markedly beneficial role of citric acid in the treatment of the disorder. The iron sulphate-citric acid mixture should be prepared one or two days before use, whereas the iron sulphate solution alone should be used immediately after preparation.

Marsais (P.). **Le court-noué parasitaire de la Vigne.** [Parasitic court-noué of the Vine.]—*C. R. Acad. Agric. Fr.*, xxiii, 30, pp. 954–960, 1937.

This is a brief survey of some recent developments in the study of parasitic court-noué of the vine (*Pumilus medullae*) [*R.A.M.*, xvii, p. 159] in various countries, including Austria, Germany, Yugoslavia, and Czechoslovakia. Most of the work referred to has been noticed in this *Review*, but the following observation by Mohorčič in Yugoslavia may be mentioned. The invasion of the pith by *P. medullae* entails a loss of the natural permeability of the cells, which are no longer able to carry out normally their work of distribution of the nutrient elements; the tendrils, deprived of their essential phosphorus, cease growth, and the foliar system suffers. The movement of potassium, another important element in tissue development [ibid., xvi, p. 794], is also impeded,

while the abundant lime salts of the pith membranes are prevented from exercising their normal stabilizing action on the cells.

MÜLLER (K.). **Entwicklung der Reben-Peronosporabekämpfung in Baden.** [The development of Vine *Peronospora* control in Baden.] —*NachrBl. dtsch. PflSchDienst,* xii, 4, pp. 195–205, 7 figs., 1938. [English, French, and Spanish summaries on pp. 343, 345–346, 348.]

Meteorological conditions in Baden (i.e., excessive precipitation in the Black Forest) are stated to be particularly conducive to the epidemic development of vine downy mildew (*Peronospora*) [*Plasmopara viticola*] which during the period from 1907 to 1916 was responsible for a reduction of 33 per cent. of the total vine-growing area of the province. The Gutedel variety suffered the heaviest damage, being largely defoliated by the middle of August and yielding nothing but shrivelled berries at harvest time. Highly satisfactory control has been secured with nosprasen and nosprasen neutral (the latter requiring no additional lime), as well as with the standard Bordeaux mixture. In this connexion the writer emphasizes the great advantages of the 'incubation calendar' method of forecasting attacks of *P. viticola* [*R.A.M.*, xvi, p. 654], by means of which the correct spraying times have been publicly announced for the last 25 years. The economic returns from timely fungicidal applications are reflected in the average increase of yield from the Baden vineyards of 135 per cent. in the last 19 years.

STAUDERMANN (W.). **Methodisches zur Prüfung von Mitteln auf ihre Peronosporawirkung.** [Methods of testing preparations for their action against *Peronospora*.]—*NachrBl. dtsch. PflSchDienst,* xii, 4, pp. 205–217, 12 figs., 1937. [English, French, and Spanish summaries on pp. 344, 346, 349.]

In the autumn of 1932 the writer began to develop a laboratory method, applicable throughout the year, of testing disinfectants for their action against vine downy mildew (*Peronospora*) [*Plasmopara viticola*: *R.A.M.*, xvii, p. 52, and preceding abstract]. Plants of the susceptible Sylvaner variety, grown in pots, are inoculated once a week, stored for three hours in a damp room, and then transferred to a hothouse for the incubation period of the fungus. During the night from the sixth to the seventh day the plants are again exposed to infection in a moist chamber. The fungicides are tested for their prophylactic action, effects on a conidial suspension of *P. viticola*, adherence to the foliage (for the determination of which a special apparatus has been constructed), and efficacy after infection. In conclusion, the method of estimating the relative value of the different preparations (by accurate counts of the number of leaf infections) is described and its practical bearings discussed.

VANDERWALLE (R.). **Notes phytopathologiques.** [Phytopathological notes.]—*Bull. Inst. agron. Gembloux,* vi, 3–4, pp. 191–195, 2 figs., 1937. [Flemish, German, and English summaries.]

In July, 1936, chicory growing in Belgium developed a leaf spot followed by the gradual destruction of all the aerial parts, the roots

at harvest time being smaller than those of healthy plants, and showing, when cut, a brown discoloration at the collar. Under forcing conditions the affected roots rotted subsequently in the silo.

Isolations from affected leaves yielded a species of *Alternaria* in association with a species of *Phoma*; the latter was shown by inoculations to be parasitic. The spherical, non-ostiolate pycnidia measured 90 to 110 μ in diameter and the oblong pycnospores 5 to 7·5 by 2 to 2·5 μ. Inoculations of chicory plants with this fungus gave oily, transparent lesions on the leaves, quickly spreading along the veins, and, on young leaves, quickly turning brown and falling out. The root vessels turned brown, but showed no structural alteration. When cultivated under forcing conditions the inoculated plants showed inferior foliage development to the controls but were otherwise normal, and it is considered that the losses experienced by growers were probably due to the weakened condition of the plants and subsequent infection by *Sclerotinia libertiana* [*S. sclerotiorum*].

Inoculations of white grapes with *Botrytis cinerea* isolated from brownish spots beneath the epidermis of other fully grown white grapes reproduced the condition when the berries were wounded and kept for a few days at 25° C. Inoculations of unwounded berries gave negative results. The lesions continued to develop during cold storage, and the weakening of the epidermis allowed the juice to emerge, with rapid development of saprophytes. In nature, infection probably takes place following insect punctures and mechanical injury.

Report of the Latvian Institute of Plant Protection for 1936–37.—Latvian Chamber of Agriculture, pp. 67–83, 1937. [Latvian, with English summary.]

In a list of the most important plant diseases observed in Latvia during 1936 the following new records are mentioned: *Puccinia asparagi* on asparagus, and *Pseudoperonospora cannabina* [*R.A.M.*, xvi, p. 749] and *Diplodina cannabicola* Pet. on hemp.

Ceresan (100 gm. per 50 kg. seed-grain) gave the highest increase of yield in rye treated by H. Eglits with various preparations for the elimination of *Fusarium* spp. The same worker reduced the incidence of *Rhizoctonia* [*Corticium solani*] on potato tubers by $2\frac{1}{2}$ times as compared with the untreated controls by treatment with aretan [ibid., xv, p. 74].

Park (M.) **Report on the work of the Mycological Division.**—*Adm. Rep. Dir. Agric., Ceylon, 1936*, pp. D28–D35, 1937.

Plant disease investigations in Ceylon in 1936 demonstrated that in *Hevea* rubber areas undergoing rejuvenation the cutting out of trees stimulates the activity of root parasites, especially *Fomes lignosus* [*R.A.M.*, xvii, p. 202]. All roots should therefore be completely removed, even if the disease is quiescent.

Rice from Mannar and the Jaffna Peninsula was affected by the disease known locally as 'senthal'. Affected plants develop a pinkish, tubular shoot, followed by the suppression of further growth. Tillering is stimulated under favourable growth conditions. The condition is found chiefly on sandy soils, especially those given heavy dressings of

bulky green manures which have incompletely decayed. It is also associated with excessive drying of the fields at an early period of growth, and occurs only in localities exposed to the south-west winds. It does not develop when the young plants have received sufficient water.

The leaf-miner *Phyllocnystis citrella* was found to be an important agent in the spread of citrus canker [*Pseudomonas citri*: ibid., xvi, p. 153]. None of the fungicides tested has given more than partial control of this disease. The evidence obtained showed that heavy picking of diseased leaves should not be undertaken at the beginning of a dry period, as this may induce sun cracking; the best time in a semi-dry area is with the first showers after a dry spell, just before the new burst of foliage develops. There appears to be a negative correlation between rainfall and leaf-miner epidemics, and a positive one between canker incidence and rainfall.

When five sweet orange, mandarin orange, and lime trees severely affected with mottle leaf [ibid., xvii, p. 105] were sprayed with 1 gall. each of a mixture of $\frac{1}{2}$ lb. zinc sulphate and $\frac{1}{2}$ lb. hydrated lime, in 5 galls. water, with a neutral spreader, marked improvement took place.

The spraying of tobacco nursery seedlings with colloidal copper markedly reduced damping-off (*Pythium* sp.) [ibid., xvi, p. 566] and also the amount of frog-eye [*Cercospora nicotianae*: ibid., xvi, p. 713] developing after transplanting; the evidence indicated that the frog-eye was caused by infection from the soil.

Surat ginger imported from India and planted in the central and south-western divisions of Ceylon developed a soft rot caused by *P. myriotylum* [ibid., xiv, p. 473], which inoculations in the laboratory showed to be an active parasite on all varieties of ginger, though it was not found on any ginger except that imported from India. All the Surat plants were at once destroyed, except in one area where the ginger was closely watched, each of the diseased plants being uprooted and destroyed and the soil disinfected. The number of plants so removed was found to diminish steadily, few new infections appearing by the time the crop was fully grown. The local species responsible for ginger soft rot is probably *P. complectens* [cf. ibid., xv, pp. 137, 632]. More than one species of *Pythium* may be responsible for the disease in India.

Other new diseases recorded included *Ustulina zonata* causing collar rot of sweet orange, *Rosellinia bunodes* causing root disease of *Artocarpus integer* and *Hevea* rubber, *Fomes noxius* causing brown root disease of *Bombax malabaricum*, pink disease (*Corticium salmonicolor*) of grapefruit [ibid., xiv, p. 627], root disease (*F. lignosus*) of *Crotalaria anagyroides*, dahlia powdery mildew (*Oidium* sp.) and leaf disease (*Entyloma dahliae*) [ibid., xvi, p. 464], stem disease of *Dianthus barbatus* caused by *Sclerotium rolfsii*, collar and rhizome disease (*Rhizoctonia* [*Corticium*] *solani*) of *Elettaria cardamomum*, leaf spot (*Piricularia oryzae*) of *Eleusine coracana*, leaf disease (*Septoria* sp.) of *Gerbera jamesonii*, tomato fruit rot (*Oospora lactis parasitica*) [ibid., xiii, pp. 288, 547], rice foot rot (? *Cephalosporium* sp.), pod disease (*Cercospora sesami*) of gingelly [*Sesamum orientale*], and nasturtium [*Tropaeolum*] root and stem disease (*Corticium solani*).

SHEPHERD (E. F. S.). **A revised list of plant diseases occurring in Mauritius.**—*Bull. Dep. Agric. Mauritius* (Sci. Ser.) 23, 14 pp., 1937.

This is a revised annotated list, arranged in alphabetical order of hosts, of the bacterial, fungous, virus, and physiological diseases of plants occurring in Mauritius [*R.A.M.*, xii, p. 115].

VENKATARAYAN (S. V.). **Report of work done in the Mycological Section during the year 1935–1936.**—*Adm. Rep. agric. Dep. Mysore, 1935–6*, pp. 51–55, 1937.

Koleroga disease [*Phytophthora arecae*: *R.A.M.*, xv, p. 77] of areca palm [*Areca catechu*] is stated to be spreading gradually from west to east in Mysore, and depots for the sale of sprayers and chemicals are being closed down in localities where they are no longer required and opened up in the new areas where the disease has appeared. 'Hidimundige roga' [loc. cit.] or 'narrow crown disease', of the same host, which is becoming more frequent and widespread, greatly resembles the West Indian coco-nut little leaf [ibid., xv, pp. 2, 128].

'Katte' disease of cardamoms [*Elettaria cardamomum*], stated to be due to a species of *Coniothyrium* [cf. ibid., iv, p. 110; xvi, p. 154] caused about 70 per cent. loss among nursery seedlings.

A rice disease known locally as 'karikaddi roga' and stated to be due to a species of *Ephelis* has markedly increased in recent years in Mysore and Shimoga. The condition appears when the earheads begin to form and causes a reduction of yield. In culture, the fungus grows very slowly, sporulating freely.

A strain of *Piricularia* from ragi [*Eleusine coracana*] earheads was found in culture to show a prominent grey colour in the mycelium and spores, and to form dark chlamydospores.

Wet rot of tobacco nursery seedlings due to *Pythium aphanidermatum* [ibid., xv, p. 2] was arrested by the prompt removal of the diseased plants and spraying the remainder with 1 per cent. Bordeaux mixture, the same spray application also controlling *Cercospora* leaf spots. In the field, powdery mildew (*Erysiphe cichoracearum*) occurred in nearly all the tobacco plots, but was checked by the removal of the basal leaves and spraying with Bordeaux mixture.

Apple mildew [*Podosphaera leucotricha*] was controlled by spraying with groundnut oil Bordeaux mixture, which (at a concentration of 1 per cent.) also gave good control of vine downy mildew [*Plasmopara viticola*].

HANSFORD (C. G.). **Annual Report of the Plant Pathologist, 1936.**—*Rep. Dep. Agric. Uganda, 1936–37* (Part II), pp. 43–49, 1938.

During 1936 it was ascertained that the most important cause of cotton wilt in Uganda [cf. *R.A.M.*, xvi, p. 234] is *Verticillium dahliae* [ibid., xvii, p. 240]. Though not before recorded from the Protectorate, this fungus was isolated from over 90 per cent. of the diseased cotton samples examined early in the 1936–7 season. Inoculations of cotton plants with the organism gave typical symptoms of wilt. It is impossible to distinguish between the symptoms of *V. dahliae* and those caused by *Fusarium* spp. [loc. cit.] in the field, and when both are present in the wood, *V. dahliae* often becomes overgrown by *Fusarium*.

No cotton variety grown locally is completely resistant, and three wilt-resistant varieties from the United States showed infection. One group of varieties grown locally reacts to infection by shedding the larger leaves but retaining the bolls, which ripen in the usual way, and developing a second flush of leaves. In 1936 these varieties (though infected) produced a satisfactory crop, and it may prove possible to breed varieties of this tolerant type which will produce good crops in spite of infection. The external and internal symptoms of *Macrophomina phaseoli* on cotton [ibid., xvi, pp. 249, 672] are sometimes very difficult to distinguish from wilt. *V. dahliae* was also isolated from wilted plants of *Abroma augusta*, cassava, simsim [*Sesamum orientale*], and a native species of *Triumfetta*. That the fungus is indigenous was shown by the fact that cotton seed from wilt-free plants sown in land not previously planted to cotton gave 59 per cent. infection, while a neighbouring plot of *A. augusta* showed about 5 per cent. infection.

Infection of cassava by *V. dahliae* has hitherto been observed only at Bukalasa, where it developed on land where cotton had been infected two years before the cassava was planted. Inoculation tests showed the 'bitamsi' variety to be comparatively resistant.

Two cases of tobacco wilt caused by a *Fusarium* of the *elegans* group and thought to be *F. oxysporum* var. *nicotianae* [ibid., xvi, p. 658] were noted for the first time. Tobacco at Bukalasa also developed hollow stem (*Bacterium* [*Erwinia*] *aroideae*) [ibid., xvi, p. 841].

S. orientale is widely affected by two leaf spot diseases, previously confused. One, due to *Cercospora sesami* [ibid., xii, p. 422], appears as small, generally round, papery, white to yellowish-brown spots on both surfaces, while the other, due to *Cylindrosporium sesami* n.sp. [with a Latin diagnosis], appears as more diffuse, irregularly angular to round, sometimes indistinctly zonate, dark reddish-brown spots 2 to 5 mm. in diameter, with a raised margin, often becoming confluent, especially round the edges of the more mature leaves. Infection by the latter fungus often spreads to the young leaves at the top of the plant, and severe infection may cause heavy loss. The same host was also affected by two bacterial rots, one causing a dark red rot of the interior of the stem, and the other a water-soaked, dark green rot.

Some cassava varieties were widely affected by *Bact. cassavae* n.sp., producing dark green, water-soaked, angular leaf spots 1 to 2 mm. in diameter, especially on the lower surface. The older spots became confluent, and were often arranged in irregular lines along the main veins, though they often developed round the edges of the spots caused by *Cercospora cassavae* [*C. henningsii*] [ibid., xv, p. 280]. On very susceptible varieties complete ringing at the original site of infection was followed by the death of the distal parts. In culture, the bacteria (inoculations with which into young cassava shoots gave typical symptoms) formed very short, Gram-negative, non-alcohol- or acid-fast rods with a few peritrichiate flagella; agar colonies were round, smooth, lens-shaped with entire edges, translucent, yellow, and of uniform structure.

P.O.J. 2822 sugar-cane was severely affected by mosaic, and should be abandoned. Scattered individual stools of P.O.J. 2725 and P.O.J. 2878 developed a dry basal rot caused by a species of *Marasmius* and

corresponding to the 'acute' form of *Marasmius* root rot found in the West Indies [ibid., xv, p. 465].

A bacterium, apparently *Bact. phaseoli*, was isolated from water-soaked leaf spots on beans [*Phaseolus* sp.].

Tephrosia candida showed minute, white, later raised, corky lesions on the leaves, petioles, branches, and inflorescences caused by *Elsinoe tephrosiae* n.sp. [with a Latin diagnosis]; these were not in themselves harmful, but were invaded by other organisms, including *Cladosporium herbarum* and *Fusarium*, which rotted the bark round the original lesion and killed the wood of the branch. Attack on the main stem was followed by the death of the whole plant. The fungus has asci 18 to 23 μ in diameter and oblong-elliptical, 3- to 4-septate ascospores measuring 13 to 15 by 6 to 7 μ, constricted at the middle septum and also showing one longitudinal septum.

Various species of *Fusarium*, including forms belonging to *Hypomyces ipomoeae* [ibid., xv, p. 343], *Lisea*, and *Gibberella* were isolated from pigeon pea plants which had died off from the top downwards; the *Gibberella* species appeared to be the primary parasites. The disease is distinct from the wilt reported from India as due to *F.* [*vasinfectum*: ibid., xvi, p. 151].

The common leaf spot of *Hibiscus rosa-sinensis* was identified as due to *Bact. hibisci* [ibid., ii, p. 413]; a different, as yet unidentified, bacterium was isolated from a fruit rot of *H. esculentus*.

Mackie (J. R.). **Annual Report on the Agricultural Department, Nigeria, 1936.**—43 pp., 1937.

Experiments have conclusively proved that cacao black pod [*Phytophthora palmivora*: *R.A.M.*, xvi, p. 660] can be kept under control in the south-western provinces of Nigeria by measures which any native farmer can carry out, namely, the regular harvesting of all ripe pods at intervals of three to four weeks during the fruiting season, the removal of all dead wood after the trees have flushed in April, and of all dead pods, which can be left on the ground.

Cassava mosaic [ibid., xvii, p. 94] has now spread northwards from the coast to Ilorin. Resistant varieties have been imported, and some strains have been developed which, so far as tested, appear to be highly resistant to the disease.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlviii, 12, pp. 683–687, 6 figs., 1937.

Brief popular notes are given on the following plant diseases found in New South Wales, viz., black end of pear [*R.A.M.*, xv, p. 729] (by W. A. Birmingham), *Bacterium campestre* [*Pseudomonas campestris*: ibid., xvi, p. 721] and *Phoma lingam* [ibid., xvi, p. 493] on cabbages and cauliflowers, blossom-end rot of tomatoes [ibid., xvii, pp. 212, 216], and aster wilt (*Fusarium conglutinans* [var.] *callistephi*) [ibid., xvii, p. 247].

Black end is confined locally to a few pear fruits on individual William trees and appears to be most pronounced on soils that dry out quickly. The available evidence indicates that the rootstock *Pyrus serotina* is responsible for the condition, the Kieffer and *P. ussuriensis*

stocks also being to some extent conducive to the disease. Black end does not occur on varieties worked on *P. communis*. There is no indication that the disease spreads from tree to tree; the same percentage of fruits are affected from year to year, the development of black end fruits sometimes increasing in rapidity two to three months after blossoming. Complete ringing of the stock with a chisel gave perfect control after one or two seasons.

The method of hot-water seed treatment recommended against *Bact. campestre* and *P. lingam* consists in suspending the seed in cheese-cloth bags in 3 or 4 galls. water kept constantly at 122° F. for 18 mins. for cauliflower and 25 mins. for cabbage and turnip seed.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 1, pp. 17–21, 7 figs., 1938.

In these notes it is stated that some years ago a few vines of a water-melon being grown in New South Wales under the name of 'Grey Monarch', which has white seeds and is susceptible to *Fusarium* [*bulbigenum* var.] *niveum* [*R.A.M.*, xvi, p. 439], gave melons with dark seeds resistant to the disease. Investigations confirmed the resistance of this type of melon, which has been named 'Hawkesbury Wilt Resistant' [see above, p. 290], and demonstrated that it has good commercial qualities. Susceptible melons can be grown in uncontaminated or new soil, provided the seed is disinfected by 5 to 10 minutes' immersion in mercuric chloride solution (1 in 1,000).

In moist, warm conditions considerable damage is frequently caused to snapdragons [*Antirrhinum majus*] in New South Wales by anthracnose (*Colletotrichum antirrhini*), which on the leaves and stems of plants of all ages produces sunken, oval or circular, yellowish-green to dull white spots with a narrow, brown border. Control consists in raising the seedlings in clean seed-beds and spraying periodically with Bordeaux mixture (4–4–50).

Martyn (E. B.). **Report on the Botanical and Mycological Division for the year 1936.**—*Div. Rep. Dep. Agric. Brit. Guiana, 1936*, pp. 77–81, 1938.

This report [cf. *R.A.M.*, xvi, p. 155] contains the following items of interest. A small outbreak of top rot of sugar-cane [ibid., v, p. 345; xii, p. 787] occurred on D. 625 on the East Coast at the end of the mid-year rains in August. The affected plants recovered after two irrigations.

Coffee leaves from the west coast of Demerara, apparently infected with *Corticium koleroga* [ibid., xi, p. 431], were received in January. *Sporotrichum citri* [*Elsinoe fawcetti*: see below, p. 312] was observed on a plant of Sampson tangelo [tangerine × pomelo] in the north-west district [ibid., xv, p. 202]. *Aschersonia cubensis*, associated with a Lecaniid scale, occurred on grapefruit leaves in the West Bank district of Demerara. In the same district a recurrence of witches' broom [*Marasmius perniciosus*: loc. cit.] was found in August on a cacao tree, which had apparently been free from it for some time and had been heavily pruned earlier in the year. In July the occurrence of a wilt of nearly mature groundnuts, associated with a species of *Thielavia*, was reported from sub-station Cecilia.

Squibbs (F. L.). **Annual Report of the Department of Agriculture, Seychelles, 1936.**—30 pp., 1938.

On pp. 18–19 of this report the following fungi, identified at the Imperial Mycological Institute, are recorded as occurring in the Seychelles in 1936: *Phytophthora palmivora* [*R.A.M.*, xvi, p. 300] causing coco-nut heart and bud rot; *Himantia stellifera* [ibid., xvi, p. 774] on *Cymbopogon citratus*; and a non-septate mycelium resembling that of a *Phytophthora* or a *Pythium* on diseased stems of *Gramatophyllum speciosum*. Swellings at the crown of *Eucalyptus citriodora* seedlings were attributed to *Bacterium tumefaciens* and were in the form of paired tumours arising in the axils of the cotyledons, which in some cases had become united. A premature leaf fall of the same host was associated with leaf spots on which a species of *Phyllosticta* occurred.

Bitancourt (A. A.). **Brazil: diseases of cultivated or useful plants, observed in the State of São Paulo.**—*Int. Bull. Pl. Prot.*, xi, 12, pp. 269–275, 1937.

A list is given of the fungal, bacterial, virus, physiological, and indeterminate diseases of economic and ornamental plants observed in São Paulo, Brazil, from 1931–36.

Bitancourt (A. A.). **Relação das doenças e fungos parasitas observados na secção de phytopathologia durante os annos 1935 e 1936.** [Report on the diseases and parasitic fungi observed in the Phytopathological Section during the years 1935 and 1936.]—*Arch. Inst. biol. Def. agric. anim., S. Paulo*, viii, Suppl. 4, pp. 315–322, 1937.

The following are among the items of interest in this list of diseases found affecting cultivated plants in São Paulo, Brazil, during 1935 and 1936 [cf. *R.A.M.*, xv, p. 487, and preceding abstract]. Dwarf bananas (*Musa cavendishii*) were infected by 'squirter disease' (*Nigrospora*) [cf. ibid., xvii, p. 223]. Apples were attacked by *Corticium salmonicolor* [ibid., xv, p. 633] and *C. koleroga*, and pears by *Stilbum cinnabarinum* [*Megalonectria pseudotrichia*: ibid., xiv, p. 459]. Tomatoes exposed for sale bore pale-coloured, yellow or green, zonate, sometimes necrotic and sunken lesions reminiscent of those due to spotted wilt. *Claviceps paspali* was observed on *Paspalum dilatatum* [ibid., xvi, p. 753, and below, p. 326].

Annual Report of the Agricultural Experiment Station, Rio Piedras, Puerto Rico, 1935–36.—135 pp., 1937.

In the sections of this report dealing with botany and plant pathology (by M. T. Cook, pp. 39–46, and A. Roque, pp. 47–52) it is stated that during the period under review a severe epidemic of cucumber mosaic occurred in Porto Rico [*R.A.M.*, xvi, p. 114], several fields showing almost 100 per cent. infection, though previous examinations of cucumbers since 1923 have never shown more than an occasional diseased plant. The same host was also affected, for the first time, apparently, by bacterial fruit rot (*Bacterium lacrymans*) [ibid., xv, p. 553], which

caused very heavy losses during shipment. Dipping the fruits in disinfectants gave encouraging results.

Other new records for Porto Rico were anthracnose of grapes (*Gloeosporium ampelophagum*) [*Elsinoe ampelina*: ibid., xvii, p. 17], blossom blight of zinnia, due to an undetermined cause, yautia [*Xanthosoma* sp.] tuber rot (*Bact. carotovorum*) [*Erwinia carotovora*], yam [*Dioscorea* sp.] mosaic, papaw(?) yellow mosaic, and downy mildew (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) [ibid., xvi, p. 590] on Persian melons.

A new strain of tomato (LJX–7) has been developed which is more resistant to *Bact. solanacearum* than Marglobe. Derived from a cross between Louisiana Pink and a native, tolerant type (JX), it appears to be very well suited for the local market. A commercial variety of egg-plant resistant to *Bact. solanacearum* has also been developed.

Black tip of plantains [? *Helminthosporium torulosum*: ibid., xvii, p. 191] appears to be increasing. The pathogenicity of the fungus isolated from affected fruits was established, and effective control was given by one to three applications of Bordeaux mixture (3–3–50) during the emergence of the raceme and before fruit-setting. During the spraying trials the sprayed and unsprayed racemes were artificially inoculated after the applications were made, on the same day, and while none of the sprayed racemes became infected all the unsprayed ones later developed the disease. The virus-like rolling of the spindle of 'enano' plantains [ibid., xvi, p. 114] is the most important problem in the banana disease project.

Pineapple wilt, introduced on two different shipments from Hawaii [ibid., loc. cit.], was controlled by destroying the mealy-bugs and ants infesting the plants.

Lima beans [*Phaseolus lunatus*] were widely but not severely affected by *Nematospora phaseoli* [*N. coryli*], some of the pods being so deformed as to suggest insect injury.

Sugar-cane gummosis (*Phytomonas* [*Bact.*] *vasculorum*) has almost disappeared from the island, but occurs on Vieques and at Fajardo.

The cucumber strains 35–2, 100, 8–5, and 8–3–2 all showed high resistance to mildew (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) and produced fruits without requiring to be sprayed.

Young cotton plants were attacked by an *Alternaria* spot, the disease disappearing as the plants developed. The organism, which appeared to be seed-borne, was found to be morphologically different from that causing a similar disease in Trinidad.

Verslag van den Directeur van het Algemeen Proefstation der A.V.R.O.S. over het tijdvak 1 Juli 1935—30 Juni 1936 en het tijdvak 1 Juli 1936—31 December 1936. [Report of the Director of the Avros General Experiment Station for the periods 1st July, 1935, to 30th June, 1936, and 1st July, 1936, to 31st December, 1936.]—*Meded. alg. Proefst. Avros*, Alg. Ser. 58, 44 pp., 1937.

The following are among the items of phytopathological interest in the botanical section of this report on matter relating to agricultura crops in Sumatra, prepared by W. F. van Hell. The damage caused in rubber plantations by mouldy rot (*Ceratostomella fimbriata*), *Fusarium*,

and stripe canker (*Phytophthora*) [*palmivora*: *R.A.M.*, xvi, p. 772] is stated to be largely controllable by the treatment of the tapping wounds with coal-tar oil (9 : 1) or resin-oil (60 : 40) mixtures, especially during the rainy season, the cost of the former being about 9 cents per kg. The clone Avros 52 suffered from a disorder of obscure origin characterized in the early stages by the development on the tapping surface of small, circular to oval, necrotic spots exuding latex, which subsequently accumulated between the wood and bark, causing the formation of lumps. Another disturbance of uncertain etiology affected the clone Avros 163, on which woody excrescences developed along the stem bark from the lowest branches downwards, causing a tendency to rupture.

No explanation is as yet forthcoming of a relatively innocuous oil-palm rot characterized by the presence in the centres of the stems of hollow, necrotic lesions. Some palms were also observed on one estate to be affected by a die-back of the tops, sometimes succeeded by the formation of a new growing point. *Fomes noxius* [ibid., xvi, p. 160, and below, p. 314] continues to be prevalent and little is done to combat it.

Botryodiplodia theobromae, *Ustulina maxima* [or *U. zonata*: ibid., iv, p. 69], and *F. lucidus* [*Ganoderma lucidum*] were found on *Albizzia falcata*. A dead tea bush bore the fructifications of *F. applanatus* var. *tornatus*, while *Rhizoctonia bataticola* [*Macrophomina phaseoli*] was present in the slender roots of the same host. A 'cobweb' fungus of the marasmioid type (without anker cells) was locally destructive to the green manures *Centrosema*, *Pueraria*, and *Vigna*.

Teak (*Tectona grandis*) was infected by slime disease (*Bacillus* [*Bacterium*] *solanacearum*) [ibid., xiv, p. 153].

Fiftieth Annual Report of the Colorado Agricultural Experiment Station, 1936–37.—62 pp., 8 figs., 1937.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xvi, p. 88]. The development by self-fertilization of homozygous strains of lucerne combining winter hardiness with resistance to bacterial wilt [*Aplanobacter insidiosum*: ibid., xvii, p. 252], leaf spot [*Pseudopeziza medicaginis*], and mildew [*Peronospora trifoliorum*: ibid., xii, p. 177; xvii, p. 44] is a problem requiring protracted experimentation. At present the wilt-resistant strains are susceptible to the two other diseases and vice versa.

A reduction in the incidence and arrest in the spread of peach mosaic have been effected by the joint efforts of the State Botany Section and the United States Bureau of Entomology and Pest Control, only 3,100 fresh cases being recorded up to 1st June, 1937, as compared with 9,835 and 30,467 in 1936 and 1935, respectively. All varieties cultivated in the Palisade district were found susceptible to mosaic [ibid., xvi, p. 820], which has been also transmitted to apricots, while Hungarian prunes grafted on infected peaches contracted the symptoms of the disease. There are indications that *M*[*yzus*] *persicae* is a vector of peach mosaic; *Lygus pratensis* and *A*[*phis*] *helichrysi* are also under suspicion in this connexion.

A species of *Phytophthora*, apparently identical with that responsible for pepper [*Capsicum annuum*] wilt [*P. capsici*: ibid., xvii, p. 157]

caused a soft, gelatinous rot of green and ripe cucumbers. The fungus was isolated from diseased material and its pathogenicity demonstrated.

A species of *Rhizoctonia* repeatedly isolated from beets [see below, p. 366] was shown by inoculation experiments to act as a weak vascular parasite.

Several strains of the causal organism of pink root of onions [*Phoma terrestris*: ibid., xvii, p. 7] appear to be present in the State, those isolated from certain soils being more than ordinarily virulent.

The Katahdin potato variety, which is undergoing extensive trials in all parts of the State, produces an exceptionally high percentage of No. 1 marketable tubers, gives yields comparable to those of the best local standard variety, and is resistant to mild mosaic, though susceptible to scab [*Actinomyces scabies*], haywire [ibid., xvi, p. 490], and spindle tuber. No significant reduction in the incidence of scab was obtained by soil treatments with calomel [mercurous chloride], yellow oxide of mercury, zinc amalgam, or copper amalgam, but the last named produced a substantial increase of yield.

VERONA (O.) & LUCHETTI (G.). **Note sull' azione di alcuni coloranti organici sullo sviluppo di tumori sperimentali da Bact. tumefaciens.** [Notes on the action of certain organic dyes on the development of experimental tumours caused by *Bacterium tumefaciens*.]—*Boll. Fac. Agraria, Pisa*, xiii, 15, pp. 193–195, 1 fig., 1937.

The results of experiments in which solutions of different concentrations of brilliant green and malachite green [*R.A.M.*, xv, p. 244] were introduced directly into tumours artificially induced on castor [*Ricinus communis*] seedlings by *Bacterium tumefaciens* are stated to have shown that at concentrations innocuous to the host these organic dyes had no effect on the tumours, while at higher concentrations they were lethal to the host plant.

GRIEVE (B. J.). **Studies in stimulation phenomena in plants due to Bacterium solanacearum.**—*Proc. roy. Soc.*, Ser. B, cxxix, 835, p. 42, 1937.

Further studies are stated to have shown that petiole-epinasty in tomato and other plants invaded by *Bacterium solanacearum* [*R.A.M.*, xv, p. 539; cf. also ibid., xvi, pp. 201, 285] is independent of gravity, and that heteroauxin is not produced in sufficient amount in the invaded vessels to bring about this growth reaction. The balance of evidence is taken to indicate that the proximate cause of petiole epinasty is some, as yet unidentified, by-product of bacterial metabolism, and a possible mechanism of the reaction is suggested.

ELLIOTT (CHARLOTTE). **The genus Phytomonas.**—*Phytopathology*, xxvii, 12, pp. 1181–1182, 1937.

The author cites data showing that the name *Phytomonas*, adopted by the Society of American Bacteriologists in Bergey's Manual, 1923, for plant-parasitic bacteria is inadmissible, since it was antedated by the flagellate genus *Phytomonas* 1909. The name *Erwinia* for plant-pathogenic rods with peritrichiate flagella will probably become more

widely used in place of *Bacillus*, which cannot now be applied to these species [*R.A.M.*, xvi, p. 482]. For other bacteria, two alternatives are open to plant pathologists, who may either follow Migula in the use of *Pseudomonas* for polar flagellate and *Bacterium* for non-motile rods, or adopt Smith's application of *Bacterium* to polar flagellate and *Aplanobacter* to non-motile plant-pathogenic bacteria.

OKABE (N.). **Studies on the variation of Bacterium solanacearum (preliminary report).**—*Ann. phytopath. Soc. Japan*, vii, 2, pp. 95–104, 1 pl., 1937. [Japanese, with English summary.]

Bacterium solanacearum, the agent of brown rot of Solanaceae and other plants, is well known to be very variable, not only in pathogenicity, but also in its morphological, physiological, and cultural characters. The organism was shown by the author's studies to consist of at least 16 types, of which four, viz. 'F', 'Op', 'C' [*R.A.M.*, xvii, p. 17], and 'SS' (forming circular, pale fluorite-green colonies with cream-coloured centres), were isolated from naturally infected tomatoes, tobacco, and eggplants in the field, while the remainder arose in subcultures from the four original isolates on various standard liquid media. Type 'F' is believed to represent the original form of *Bact. solanacearum*, while 'Op', 'C', and 'SS' are variants developing spontaneously in the tissues of diseased hosts which are found only in advanced stages of the rot or in old lesions. Ten of the 12 mutants are unstable in liquid media and readily change to other types. All the types of *Bact. solanacearum* under discussion are susceptible to the lytic action of the bacteriophage specific for the organism [loc. cit.].

ISAKOVA (Mme A. A.). **Effect of bacteriorhizal complexes on the development of the Sugar-Beet.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xvii, 3, pp. 150–152, 1937.

In the course of pot experiments with the Uladovka variety of sugar beet, the author treated the seeds of the plant with cultures of bacteriorrhiza [*R.A.M.*, xvi, p. 698] of the beet, pea, and lupin, as well as with *Azotobacter*, alone or combined with either of the three bacteriorrhiza, the treatment being sometimes repeated two or three times. The comparison of the treated plants with the controls showed that the maximum invigorating effect was obtained by the treatment with *Azotobacter* together with the bacteriorrhiza of the beet or pea, and that repeated treatment increased the effect.

From the similarity of the effect of *Azotobacter* to that of the bacteriorrhiza in nitrogen-rich soil, it is concluded that the effectiveness of the former cannot be due to its nitrogen-fixing ability, but is more probably to be explained by the accumulation of heteroauxin-like substances in the medium.

PETERSON (R. F.). **Problems in the development of rust resistant varieties of Wheat.**—*Rep. Canad. Seed Grs' Ass., 1936–37*, pp. 52–58, 1937.

This is a popular account of the problems involved in breeding superior stocks of wheat varieties resistant to stem and leaf rusts [*Puccinia graminis* and *P. triticina*]. It includes notes on desirable

characteristics, which determine the selection of parental material, and on the methods employed in breeding the hybrids. A detailed description is given of the tests for reaction to rust and other diseases, for agronomic characters, and for baking quality, which are applied before the final release of the new variety.

OLÁH (L. v.). **Über die Vererbung der Gelbrostresistenz bei verschiedenen Weizensorten.** [On the inheritance of yellow rust resistance in different Wheat varieties.]—*Z. Zücht.*, A, xxii, 1, pp. 45–74, 4 figs., 1 diag., 4 graphs, 1937.

The writer's studies on the mode of inheritance of yellow rust of wheat (*Puccinia glumarum*) [*R.A.M.*, xiv, p. 294], carried out at the Institute of Genetics and Plant Breeding, Friedrich Wilhelm University, Berlin, were directed primarily towards the solution of three problems, viz., (*a*) whether resistance is conditioned by multiple allelomorphs or evoked by other mutually independent genes; (*b*) how, if allelomorphs are not implicated, resistance is transmitted from one generation to another; and (*c*) whether protoplasm is involved in the inheritance of resistance.

The results [which are fully tabulated and discussed] of inoculation experiments with physiologic races 9 and 7 [ibid., xiii, p. 757] on the progeny of crosses between Carsten's Dickkopf, Michigan Amber, and Heine's Kolben showed segregation to be uniformly polymerous, thereby disposing of the theory of multiple allelomorphs. Transitional types of resistance may arise genotypically and not merely in response to modifying influences. It would seem that the relationships in yellow rust resistance are more complex than previous researches indicate [ibid., xvii, p. 231]. Some doubt is even cast on the existence of specific factors for inherent resistance, as opposed to the accidental escape from disease of plants maintained in a healthy condition by a coincidence of various nutritional and metabolic factors. Since almost all varieties differ in constitutional characters the highly divergent segregation relations obtaining in the various crosses are readily understandable. Although individuals resistant to both physiologic races of *P. glumarum* were found among the F_3 progeny in these experiments, they were all heterozygous. In reciprocal crosses no differences were detected that could be referred to protoplasmic influence.

SCHLEHUBER (A. M.). **Studies on the effect of bunt, Tilletia tritici and Tilletia levis, on Wheat.**—*Phytopath. Z.*, x, 6, pp. 614–631, 5 figs., 4 graphs, 1937.

Part I of these studies, concerned with winter hardiness in relation to bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] infection of wheat, was carried out at the Halle (Germany) Agricultural and Plant Breeding Institute in 1936–7, while parts II and III, dealing, respectively, with the effect of the disease on growth rate and an abnormal type of smutting, were conducted at the State College of Washington.

Freezing injury was uniformly more severe in the Oro, Ridit, and Heil's Dickkopf varieties following inoculation with physiologic races A, E, and G (Halle district) of *T. caries* than in the non-infected con-

trols, though the differences were not always significant. The largest difference between the inoculated and control series occurred in Oro infected with races E and G (especially the former), which produce no smut balls in this variety. These observations denote the necessity of considering the special relationships existing between a particular host and a given pathogen [*R.A.M.*, xvii, p. 165] in plant-breeding problems.

The effect of bunt on wheat, whether stimulatory or depressing, depends on the variety, the physiologic race of the smut, and the stage of growth of the plants. In experiments with races Ft–4 [ibid., xv, p. 344] and Ridit *caries* of *T. caries*, and with a composite mixture of the two, on Turkey-Florence and White Odessa, the blend exerted a markedly lowering effect on both varieties at the end of the second leaf-growing period; taking the components of the mixture separately, Ridit *caries*, which produced 76 per cent. bunt on Turkey-Florence and 56 per cent. on White Odessa, stimulated both varieties, whereas Ft–4 retarded the growth of the former (resistant, only 0·85 per cent. infection) and accelerated that of the latter (highly susceptible, 94·9 per cent.). In Turkey-Florence the average dry weight per plant was highest (62 mg.) in the series inoculated with Ridit *caries*, causing the highest incidence of bunt, lowest with the virtually innocuous Ft–4 (54·6), and intermediate with the mixture (57·2). A parallel relationship exists in the case of White Odessa, the maximum weight (59·6) corresponding with virulent infection by Ft–4, the minimum (57·1) with the less severe Ridit *caries*, while the mixture is again intermediate (58).

An abnormal type of smut developing in Turkey-Florence plants inoculated with physiologic race Ft–4 of *T. caries* in 1933 consists in the formation of wholly, unilaterally, or partially sterile heads associated with a varying incidence of infection. In 1934 and 1935 F_3 and F_4 plants of White Odessa × Turkey-Florence were observed to be similarly affected. The condition is believed to be due to mycelial invasion, numerous smut balls, ranging in size from a pin's head to the normal dimensions, having been detected in the diseased spikelets.

FOSTER (W. R.) & HENRY (A. W.). **Overwintering of certain cereal pathogens in Alberta.**—*Canad. J. Res.*, Sect. C., xv, 12, pp. 547–559, 8 figs., 1937.

After stating that the cereal foot rot fungi *Helminthosporium sativum*, *Fusarium culmorum*, *F. graminearum*, *Ophiobolus graminis*, *Leptosphaeria herpotrichoides*, and *Wojnowicia graminis* have been shown to overwinter under natural conditions in Alberta, Canada, both in their mycelial and conidial stages, the authors give an account of experiments, the results of which demonstrated the high resistance of these organisms to cold. Thus, for instance, young germ-tubes of *H. sativum* resumed growth after being frozen solid overnight at 6° F., and agar cultures of *H. sativum* and *F. culmorum* remained viable after a 17-day exposure to temperatures ranging from about 0° to –50°. Mycelia of all the six species grown on sterilized barley grains survived in one case three months of continuous freezing, and in another case 40 alternate freezings and thawings over a period of two months. The

conidia of *H. sativum* proved less resistant to alternate freezing and thawing than to continuous freezing, but survived the treatment longer than the conidia of *F. culmorum* and *F. graminearum*. Viability was retained more readily by *H. sativum* on the soil surface than at depths of from 2 to 12 in., and soil aeration appeared to favour its survival, but this did not hold for *F. culmorum* and *F. graminearum*. Strains of *H. sativum* from northern latitudes did not prove to be more resistant to cold than strains from more southern latitudes.

The investigations showed further that both species of wheat bunt (*Tilletia caries* and *T. foetens*) may overwinter in Alberta as mycelium on winter wheats, but not as soil-borne spores; the latter may, however, be a factor in the renewal of bunt infection of winter wheats in western Canada. Powdery mildew (*Erysiphe graminis*) was shown to overwinter in the perithecial stage at Edmonton, Alberta, ascospores being formed in the spring, at the onset of favourable conditions and just before the first infections of winter wheat were observed.

Hynes (H. J.). **Some aspects of the root-rot problem in Wheat.**—*J. Aust. Inst. agric. Sci.*, iii, 4, pp. 212–218, 1 fig., 1937.

In this brief review of the more significant results of his investigations over a number of years [a full report of which is reserved for future publication] on the relationship between the development of foot and root rots of wheat in Australia [*R.A.M.*, xvii, p. 166] and rainfall during the whole vegetation period of the crop, the author states that controlled glasshouse experiments indicated clearly that the establishment of the parasites is favoured by low soil moisture content (30 per cent. saturation) during the early (pre-ear-peeping) growth stage, and that their stunting effect on the hosts was more pronounced in the series that was adjusted to a high moisture content (60 to 65 per cent.) in the late stages of growth than in that maintained at low moisture content throughout growth. In all cases diseased plants ripened earlier than healthy ones. The fact that the damage to the wheat plants was greatest in the pots that had been inoculated simultaneously with *Helminthosporium M.* (*Curvularia ramosa*), *H. sativum*, and *Fusarium culmorum*, the damage in the pots inoculated with one or two of the fungi being considerably less, is considered to support the author's contention that in Australia foot rot is not attributable to the action of *H. sativum* alone, but is in the majority of cases due to the activity of a complex of fungi, including possibly other species apart from the three named. The results of the controlled tests did not, however, agree fully with field observations concerning the effect of rainfall and its distribution during the growing period on foot rot development in the adult wheat plant, and additional surveys are needed to settle the question. Further tests to determine the effect of grazing by sheep in the spring and of the date of sowing on the development of foot rot, showed that cutting back wheat 12 in. tall to within 1·5 in. of soil-level resulted in appreciable stunting and noticeable reduction in yield of dry matter in practically every instance, and that root disease was most severe in adult plants which had been sown late in the season.

STRAIB (W.). **Über Resistenz bei Gerste gegenüber Zwergrost und Gelbrost.** [On resistance in Barley to dwarf rust and yellow rust.]—*Züchter*, ix, 12, pp. 304–311, 1937.

Several of the 508 barley varieties tested in the seedling stage in the greenhouse at the Gliesmarode (Brunswick) branch of the Biological Institute for their reaction to eight physiologic races of dwarf rust (*Puccinia simplex*) [*P. anomala*] and five of yellow rust (*P. glumarum*) including the two specific for this host, 23 and 24 [*R.A.M.*, xvii, p. 231], proved to be highly resistant to all forms, viz., Bolivia, Quinn, Palestine, and Spanish, while a further selection showed resistance to most races of both rusts except the French No. 13 of *P. anomala*, viz., *Hordeum tetrastichum pallidum* No. 2890, Australian 22, Biggo, Estanzuela 72d, Morocco, Nebraska, Schliephacke's, and Weider. Egyptian, Chilean D, Cruzat, Granat, Estanzuela, Peruvian, Ragusa, and Recka were resistant to all or most of the races of *P. anomala* and the three non-specific ones of *P. glumarum* but susceptible to 23 and 24. Gopal, Irisaka, Japan I, Nolc's Imperial, 3169, Bavaria, Heil's Franken, and Isaria were predominantly susceptible to all races of *P. anomala* but resistant to *P. glumarum* (the three last-named, however, being susceptible to race 24). The results of field tests from 1935 to 1937 indicated that a number of varieties contracting severe infection in the seedling stage under greenhouse conditions were adequately resistant to both rusts in the field. So far, however, no markedly resistant variety has been found among the winter barleys, and in general the outcome of the trial points to a heavy predominance of susceptibility to both rusts among the test material. The elimination from field crops of yellow rust indicators, i.e., varieties on which *P. glumarum* is capable of fructifying at relatively high temperatures, should be one of the foremost objects in the barley-breeding programme.

No correlation could be traced between resistance to the rusts and to mildew (*Erysiphe graminis hordei*) [ibid., xvi, p. 804].

BRIGGS (F. N.) & BARRY (G. L.). **Inheritance of resistance to mildew, Erysiphe graminis hordei, in a cross of Goldfoil and Atlas Barleys.**—*Z. Zücht.*, A, xxii, 1, pp. 75–80, 1937.

The results of a study at the California College of Agriculture on the inheritance of resistance to barley mildew (*Erysiphe graminis hordei*) [*R.A.M.*, xv, p. 9; xvi, p. 376] in Goldfoil (resistant) and Atlas (susceptible) hybrids indicated that the former variety differs from the latter in one major factor for resistance to the disease, and that resistance is incompletely dominant. Susceptible plants segregated from the cross between Goldfoil and the resistant Hanna, showing that different factors are responsible for resistance in these two varieties. In future the factor for resistance to mildew in Goldfoil will be designated GG and that in Hanna HH. No linkage could be traced between mildew reaction and one factor pair each belonging to linkage groups 1 (non-six-rowed versus six-rowed spikes) and 2 (long- versus short-haired rachilla).

Tapke (V. F.). **Physiologic races of Ustilago hordei.**—*J. agric. Res.*, lv, 9, pp. 683–692, 1937.

A tabulated account is given of the author's studies from 1934 to 1936, inclusive, at Ithaca, New York, the results of which showed the presence in 200 collections of *Ustilago hordei* [*R.A.M.*, xvi, p. 737] from 26 of the United States of eight physiologic races, differing from one another in their reaction on five named varieties of spring barley. Of these physiologic races No. 6 was the most widely distributed, as it was found to occur in 21 of the 26 States, and was isolated from 114 of the 200 smut collections. In California and Washington, however, another race (5) was conspicuously prevalent, occurring 51 times in 60 collections from these two States; a possible explanation of this prevalence in California may be the still existing popularity of Coast barley which was introduced as early as 1770 by the Spanish missionaries. Under the conditions of a one-year (1935–6) test with 28 winter varieties or selections of barley, little clear-cut differential host response to the eight races was obtained, possibly because of marked differences in varietal response to winter injury.

The investigations also showed that Pannier (C.I. 1330) barley was highly resistant to, or immune from, seven of the eight races of *U. hordei*, and only moderately susceptible to one. *Hordeum deficiens* (C.I. 668–1) and *H. intermedium* (C.I. 4377), used only in the 1934 test, were highly resistant to, or immune from, the six races occurring in the collections of that year. These three barleys are also highly resistant to *U. nigra* [ibid., xvi, p. 375].

Levine (M. N.) & Smith (D. C.). **Comparative reaction of Oat varieties in the seedling and maturing stages to physiologic races of Puccinia graminis avenae, and the distribution of these races in the United States.**—*J. agric. Res.*, lv, 10, pp. 713–729, 8 pl., 1937.

In the course of greenhouse experiments carried out at the Minnesota Agricultural Experiment Station, inoculations with the ten known physiologic races of oat stem rust, *Puccinia graminis avenae* [*R.A.M.*, xvi, p. 446], were made on 27 varieties and strains of oats in the seedling stage and on seven of these varieties in the adult stage; six other varieties, also in the adult stage, were inoculated with race 6 only.

The results of these experiments showed that the reactions of seedling and maturing plants of every one of the varieties tested to all the parasitic races were in close agreement. It would seem, therefore, in the absence of important exceptions not falling within the limits of these experiments, that seedling reaction can be considered a reliable index of the reaction of adult oat plants to specific physiologic races of *P. graminis avenae*.

Of five physiologic races (1, 2, 5, 7, and 10) of *P. graminis avenae*, isolated during the 15-year period 1921–35 from rusted oat material collected in various parts of the United States, only races 2 and 5 have played a significant part in the stem rust epidemics of this period; race 1 was of some consequence on certain occasions but on the whole of small importance, and races 7 and 10 of none whatever, as far as the United States are concerned.

The restricted physiologic specialization of the oat stem rust fungus in the United States is favourable to the breeding of rust-resistant varieties. The varieties Hajira, Hawkeye, Iogold, Iowa D 67, Rainbow, and Richland are adequately resistant to races 1, 2, and 5 and highly resistant to race 7; the varieties Anthony, Green Mountain, Minnesota 742, Minrus, and White Tartar are at least moderately resistant to races 1, 2, 5, 7, and 10.

KITUNEN (E.). **Untersuchungen über die Lebensweise des Haferbrandes Ustilago avenae (Persoon) Jensen.** [Studies on the life-history of the Oat smut *Ustilago avenae* (Persoon) Jensen.]—*Suom. Maataloust. Seur. Julk.*, xxxv, 2, pp. 89–144, 8 figs., 1937. [English summary.]

The author tabulates and fully discusses the results of his studies on loose smut of oats, which is stated to be caused almost exclusively by *Ustilago avenae* in Finland. Samples of diseased material from the 1933–6 harvests were submitted for examination from various parts of the country, as well as from Sweden, Denmark, and Holland, and spore counts were made by washing or centrifuging. In nearly all the samples there were two to four times as many spores on the outer as on the inner sides of the glumes, but in a few instances the position was reversed, showing that either region may provide the inoculum for an attack of loose smut. Most of the spores both on the inside and the outside of the glumes were found to preserve their germinative capacity during the resting period of the seed-grain. In inoculation experiments in the field on oat flowers protected by parchment cones a maximum of one-third of the spores of *U. avenae* germinated during the first 24 hours after inoculation, mostly on the stigmas, little activity being observed among those that had fallen deeper into the flower, though they were experimentally shown to be capable of germination. During the next 24 hours renewed germination took place. Fusion seldom occurred between the sporidia ultimately developing from the spores and no resting stage was detected. Most of the mycelium found in profusion in all the samples at an advanced stage of infection appeared to belong to such common moulds as *Cladosporium* and *Heterosporium*, and in no case was a vegetative phase of *U. avenae* observed. Moderately infected samples of seed-grain may be practically freed from smut by cleansing the glumes and caryopses, thereby affording additional confirmation of the absence of overwintering mycelium within the tissues and showing that the spores, which alone are of any practical importance in the invasion of the seedling, adhere so loosely to the seed as to be readily detachable. The sporidia cannot survive drying, and can therefore play no part in the overwintering of the fungus.

McNEW (G. L.). **Isolation of variants from cultures of Phytomonas stewarti.**—*Phytopathology*, xxvii, 12, pp. 1161–1170, 1 fig., 1 graph, 1937.

From dilution plates of virulent cultures of *Phytomonas* [*Aplanobacter*] *stewarti* [*R.A.M.*, xvii, p. 238] on nutrient broth agar plus 0·5 per cent. dextrose (P_H 6·8 to 7) the writer isolated 25 variants classified, according to their capacity for producing necrotic lesions and wilting

in ten-day-old Golden Bantam maize seedlings, as slightly virulent (infection index under 0·20), weakly virulent (0·20 to 0·55), virulent (including the parent class and 16 derivatives, causing large necrotic lesions and intense chlorotic streaks), and highly virulent (over 0·90, comprising five strains producing all the symptoms of the virulent category and further causing severe wilting). Only one of the variants belonged to the slightly virulent class and two to the weakly virulent. Two white, semi-rough variants, producing a firm, white, filiform streak on transference to agar slants, developed during a seven-hour incubation of one subculture. These strains, though almost as virulent as the parent culture, only survived for seven weeks at room temperature instead of three months, the period of viability of most of the yellow colonies. Variants were isolated from cultures from infected maize plants in New Jersey, New York, and Iowa after passage through five serial dilutions.

Annual Report of the Veterinary and Agricultural Department, British Somaliland, for 1937.—27 pp. [? 1938. Mimeographed.]

During 1937 sorghum common smut [*Sphacelotheca sorghi*: *R.A.M.*, xvi, p. 666] was less prevalent everywhere in Somaliland than formerly; seed dusting with sulphur at the rate of 8 oz. per 160 lb. of seed appeared to give good results [ibid., xvii, p. 15]. Bulrush millet [*Pennisetum typhoides*] was affected by 'blindness' attributed to drying winds. A variety of maize from Kenya was badly infected by *Diplodia* [*zeae*].

Bates (G. R.). **Report of the Plant Pathologist for the year ending December 31st, 1936.**—*Rep. Brit. S. Afr. Co., Mazoe Citrus exp. Sta., 1936*, pp. 157–167, 1937.

During 1936, most of the decay found in oranges in the packing-house at the Mazoe Citrus Experimental Station, Southern Rhodesia [cf. *R.A.M.*, xvi, p. 528], was due to *Penicillium digitatum* [ibid., xvi, p. 601; xvii, pp. 106, 171]; *P. italicum* was less common than previously, but *Oospora citri-aurantii* [loc. cit.], *Diplodia natalensis*, and *Alternaria citri* were very prevalent. Excessive wastage was favoured by late rains and high temperatures.

Brown rot (*Phytophthora citrophthora*) was recorded on Valencia Late oranges for the first time.

Further experiments on the artificial infection of sound oranges with *P. digitatum* confirmed the results previously obtained [ibid., xvi, p. 528]. All the methods used in rind inoculations gave similar results, but the rate of decay was much accelerated when the original inoculum penetrated to the pulp. Evidences of tree-to-tree and seasonal variation in the rate of decay were found, which are certainly related to the intensity of wastage in the packing-house and during transit.

In investigations of dormant infections in the rind of sound, unblemished oranges no latent infections were observed on very young fruits of about 1·5 gm. weight. Oranges weighing about 20 gm. occasionally showed latent infection by *A. citri* in the rind tissues immediately below the calyx, latent infections being detected in 40 per cent. of the buttons from these fruits. Six weeks later, when the average

weight of the oranges was 49·1 gm., some 90 per cent. of several hundred pieces of rind tissue cultured contained latent infections of *Colletotrichum gloeosporioides*, while about 9 per cent. had latent infections of *A. citri*, and a similar percentage showed *Glomerella cingulata*.

Studies of cold storage injury in Jaffa oranges in relation to fertilizer treatment in the orchard showed that most damage occurred in fruit from trees given liberal dressings of phosphate, heavy potash dressings coming next, closely followed by reduced quantities of complete fertilizer, and manure only; the least injury was found in fruits from trees given a complete fertilizer mixture. Pitting was observed after one week's storage at 40° F. and reached a maximum at the end of two weeks. Scald appeared in only two samples after two weeks, but was commonly present in all samples after three weeks. It appeared to be closely correlated with transpiration; samples showing the most loss of weight during storage also developed most scald. Pitting was confined to lightly coloured fruits after one week's storage, and was found especially in oranges with pre-picking blemishes, the original scars forming foci for the development of cold injury. A new type of blemish found in cold storage consisted of irregular, depressed lesions, mostly at the stem-end and involving both flavedo and oil vesicles. It would appear to be associated with gradual desiccation, possibly accentuated by mechanical injury or excessive pressure during early handling.

Some delayed wastage due to *P. digitatum* occurred among Jaffa oranges in cold storage. In one test with commercially treated Valencia Late oranges *P. italicum* and *P. digitatum* caused a small proportion of the stem-end rot that developed after prolonged storage. *C. gloeosporioides* and *A. citri* were mainly responsible for the stem-end, lateral, and centre rots occurring in storage. *D. natalensis* accounted for about 30 per cent. of the stem-end rot in Valencia Late and Jaffa oranges. *Phomopsis* [*Diaporthe*] *citri* was occasionally found. A *Septoria* spot, attributed provisionally to *S. citri* [ibid., xv, p. 774], attacked Jaffa and Valencia Late oranges after about six weeks in cold storage. *Haplosporella* (*Sphaeropsis*) *hesperedica* [cf. ibid., xi, p. 697] was isolated from Valencia Late oranges showing firm, pale brown blemishes.

Among Valencia Late oranges from different fertilizer groves the greatest amount of *A.* [*citri*] wastage occurred on fruits from trees given heavy dressings of nitrogen.

Heavily oiled and moisture-proof cellophane wrappers were conducive to increased wastage. There was, however, no significant difference as regards wastage between ordinary, untreated sulphite paper and paper containing $3\frac{1}{2}$ per cent. of mineral oil. Oranges in standard cellophane rapidly became shrivelled, while moisture-proof cellophane gave considerable control of low-temperature blemishes and loss of weight. The smallest loss in weight was shown by fruits in 15 per cent. oil-treated wrappers. Among unpacked oranges there was little difference in percentage loss of weight at 40° but at 68° all the oil-treated wrappers, especially the 15 per cent. type, checked loss of weight to some extent. Standard cellophane increased loss of weight, while moisture-proof cellophane strikingly reduced it at both temperatures. Unwrapped fruit showed a lower percentage loss in weight at both temperatures than fruit in sulphite wrappers.

Bates (G. R.). **Diseases of Citrus fruits in Southern Rhodesia.**—*Rep. Brit. S. Afr. Co., Mazoe Citrus exp. Sta., 1936*, pp. 173–208, 5 pl., 2 graphs, 1937.

In this paper the author gives a comprehensive, semi-popular account, based on several years' investigations at the British South African Company's estates, of the different rots and blemishes affecting Southern Rhodesian citrus fruits intended for the English market, special prominence being given to troubles developing in the packing-house [see preceding abstract].

Stahl (A. L.) & Cain (J. C.). **Cold storage studies of Florida Citrus fruits. III. The relation of storage atmosphere to the keeping quality of Citrus fruits in cold storage.**—*Bull. Fla agric. Exp. Sta.* 316, pp. 3–41, 7 figs., 4 graphs, 1937.

In further studies carried out in Florida on the behaviour of citrus fruits in cold storage under different gaseous and atmospheric conditions [*R.A.M.*, xvi, p. 742] pitting in Silver Cluster grapefruits was increased by storage in oxygen, and slightly decreased by storage in nitrogen, as compared with storage in ordinary air, while small quantities of carbon dioxide appeared to reduce this tendency. Sogginess, or physiological breakdown, developed abundantly in an atmosphere of carbon dioxide, and the affected fruit did not revive after treatment with oxygen. Pineapple oranges and McCarty grapefruits stored in nitrogen retained their firmness and bright colour, but developed a musty taste.

Reiniger (C. H.). **Observações sobre o emprego do metaborato de sodio no controle da podridão peduncular da Laranja.** [Observations on the use of sodium metaborate in the control of stem-end rot of Orange.]—ex *Campo, Rio de J.*, pp. 45–48, 10 figs., 1 graph, 1937. [English summary. Mimeographed.]

Immersion of oranges from a 20-year-old grove badly infected with melanose [*Diaporthe citri*] in a 6 per cent. solution of sodium metaborate gave effective control of stem-end rot (*Phomopsis* [*D.*] *citri* and *Diplodia natalensis*) [*R.A.M.*, xvii, pp. 27, 106], which in the untreated controls caused serious decay. Sodium metaborate possesses the advantage over borax of being perfectly soluble in cold water up to 6 per cent. concentration.

Parham (B. E. V.). **Citrus diseases in Fiji.**—*Agric. J. Fiji*, viii, 4, pp. 22–24, 1937.

Brief notes are given on the symptoms and control of the following diseases of citrus in Fiji, viz., mottle leaf [*R.A.M.*, xvii, p. 170], which, locally, mainly affects grapefruit, collar rot or gummosis, usually occurring on sweet orange stock budded low, but the cause of which in Fiji has not yet been ascertained, bark crack, mostly found on grapefruit, sooty mould (*Capnodium citricolum*) [ibid., xiv, p. 60], and scab (*Sporotrichum citri*) [*Elsinoe fawcetti* [ibid., xvi, pp. 655, 729].

Brown rot control.—*Calif. Citrogr.*, xxiii, 1, p. 46, 1937.

As severe damage sometimes results when citrus trees sprayed with

ordinary Bordeaux mixture against brown rot in California [*Phytophthora citrophthora*, *P. parasitica*, *P. hibernalis*, and *P. syringae*: *R.A.M.*, xvi, p. 312] are fumigated against insect infestation a few months later, and as repeated applications of Bordeaux mixture render the trees susceptible to such damage for some years after the spray applications have ceased, it is recommended that a spray composed of 12 lb. zinc sulphate, 1 lb. copper sulphate, and 6 lb. hydrated lime, with or without a spreader, should be substituted. This mixture in three years' extensive field trials has proved as effective against brown rot as Bordeaux mixture 3–3–50, and no damage has resulted from heavy applications of it made up to within a few days of fumigation. To avoid injury from drifting gas 48 hours should elapse before fumigating an orchard adjacent to one sprayed with Bordeaux mixture.

RHOADS (A. S.). **Observations on psorosis of Citrus trees in Florida.**—*Citrus Ind.*, xviii, 5, pp. 8–9, 16–17, 1937. [Abs. in *Exp. Sta. Rec.*, lxxviii, 1, p. 69, 1938.]

A survey made in 1936 of a block of 306 orange trees in Florida indicated that psorosis [*R.A.M.*, viii, p. 158; xvii, p. 106] had, since the previous survey in 1927, disappeared from 9 and appeared on 14 additional trees. In a row of grapefruit the rate of progress was comparable. New cases developed sporadically, and there was no evidence of the disease on trees replacing those removed because of the condition. Scraping the bark gave effective control except on trees in which the disease appeared to have become systemic.

COOKE (F. C.). **The practical aspects of copra deterioration.**—*Gen. Ser. Dep. Agric. S.S. & F.M.S.* 28, 49 pp., 3 pl. (1 col.), 1 fig., 1937.

In this study of the practical aspects of copra deterioration, the mycological aspects of which have been dealt with in a previous bulletin [*R.A.M.*, xvii, p. 28], and its prevention, the author, after briefly reviewing the literature of the subject, states that in Malaya attack by any of the organisms concerned requires the presence of moisture, and is most severe on the wettest pieces of copra, on copra on which moisture has condensed, and on copra stored in a stagnant, moisture-saturated atmosphere. As soon as the nut is split open the inner surface of the meat provides an ideal medium for mould and bacterial development, but there is little danger of infection when the moisture content is reduced promptly during drying to 8 and, if possible, 6 per cent. If the drying process is unsatisfactory, discontinuous, or incomplete the material softens and rots, after which a succession of moulds may develop.

In a section dealing with the prevention of deterioration the author recommends sun-drying for five hours before kiln-drying; or cracking the nuts (without splitting) and allowing the milk to drain away before placing them on the kiln. By these methods bacterial contamination can be avoided.

THOMPSON (A.). **Observations on stem-rot of the Oil Palm.**—*Sci. Ser. Dep. Agric. S.S. & F.M.S.* 21, 28 pp., 14 pl., 1937.

Observations made on a block of 720 oil palms planted on quartzite

soil with a sand-pan situated at varying depths below the surface showed that *Fomes noxius* [*R.A.M.*, xvi, p. 656] is mainly responsible for stem rot. Infection occurs by means of spores germinating on the cut surface of the leaf bases or in wounds nearer the stem, extends laterally round the stem in the outer tissue, penetrates the inner tissues, and finally causes the death of the palm after two or three years. Progress of the disease is more rapid when infection occurs near ground-level. The decayed tissue in the diseased stem is sometimes zonate, with alternating bands of dark and light brown. The cells of the darker tissue contain curled masses of dark brown, spiny, septate hyphae; the hyphae in the lighter tissue are more hyaline with fewer septa and are arranged roughly in parallel lines extending from cell to cell. The rot spreads slightly more rapidly in backward palms and abnormally quickly in palms killed by lightning. It is intensified by moist conditions and occurs mostly in areas of deep peat or on quartzite soils with a pan of sandy subsoil. *F. noxius* does not attack the roots and therefore there is little danger in burying the palms killed by it. Treatment by excision of decayed tissue is advocated only for areas, particularly of deep peat, where economic yields are still obtainable, and where supplies are likely to be less vigorous than the palms they replace. 'Hat-peg' pruning, which reduces wounding, is recommended as a preventive measure.

Other fungi found on the oil palm are relatively harmless. *Ganoderma lucidum* is responsible for a rarer form of stem rot and is apt to attack the roots, which is also true of *Ustulina zonata*, responsible for 'charcoal-base rot'. There is, therefore, a risk of root infection from buried palms killed by these fungi and burning is recommended. *G. lucidum* is regarded as a facultative parasite, but *F. lignosus* seems to be only saprophytic on oil palms.

GOIDÀNICH (G.). **Il marciume dell'infiorenza della Palma da Dattero causato da Mauginiella scaettae Cav.** [The Date Palm inflorescence rot caused by *Mauginiella scaettae* Cav.]—Reprinted from *Agricoltura colon.*, xxxi, 10, 9 pp., 5 figs., 1937.

A brief, semi-popular account, based chiefly on Chabrolin's study of the disease, is given of the symptoms, causal organism, and control of the rot of date palm inflorescences caused by *Mauginiella scaettae* [*R.A.M.*, ix, p. 239; xii, p. 303]. Practically all the information given has already been noticed in this *Review*.

CARDONA (A. N.). **Las enfermedades fungosas del Cafeto.** [The fungous diseases of Coffee.]—*Agricultura, Mexico*, i, 2, pp. 37–39, 1937.

Popular notes are given on the occurrence and control of the three most prevalent diseases of coffee in Mexico, viz., leaf spot (*Stilbella* [*Omphalia*] *flavida*) [*R.A.M.*, xvi, p. 378], thread blight (*Corticium koleroga*) [ibid., xvi, p. 657 and above, p. 298], and sooty mould (*Capnodium coffeae*) [cf. ibid., vi, p. 352; vii, p. 630].

WALLACE (G. B.). **Report on Plant Pathology.**—*Rep. Coffee Res. & Exp. Sta., Lyamungu, Moshi, 1936* (*Pamph. Dep. Agric. Tanganyika* 19), pp. 82–85, 1937.

In a comparative spraying and dusting experiment against coffee leaf disease (*Hemileia vastatrix*) [*R.A.M.*, xvi, p. 796] in Tanganyika in 1936 the best result out of 13 different treatments was given by 1 per cent. Bordeaux mixture plus linseed oil; linseed oil alone had only a negligible effect, as had groundnut oil alone or plus agral I; very little, if any, control followed two applications of each of four proprietary dusts; and the four proprietary wet sprays tested were less effective than Bordeaux mixture. In a second similar experiment, 1 per cent. Bordeaux mixture applied alone was quite effective, the following stickers and spreaders giving no advantage as regards increased retention of spray deposit: linseed oil, groundnut oil, fish oil soap, a proprietary spreader, sulphite lye, a proprietary wetting compound, alum, and resin soda.

Improved cultural practices gave 95 per cent. control of the coffee disease recently reported, and attributed to a species of (?) *Stilbum* [ibid., xiv, p. 13]. In the treated plantation about 1 to 5 per cent. of the leaves were spotted, the affected leaves showing from one to about five spots each, whereas in a neighbouring plantation abandoned two years previously about 80 per cent. of the leaves each showed 1 to 50 spots. No sclerotia or fruiting bodies were observed, and the gemmae characteristically present in nature did not develop in culture. No stage of the fungus was found by which its systematic position could be determined, and it is not at present possible to identify it.

Dry collar rot of *Coffea arabica* in the seedling stage [ibid., xv, p. 704] takes the form of callused, canker-like swellings at the collar, occasionally with marked constriction below. The epidermis covering the swellings is loose and flaky. Both the external and internal symptoms are similar to those found in older plants, and it is expected that both diseases will be found to have the same origin.

Coffee stems showed an unusual condition resembling gnarled stem canker of tea [ibid., xiii, p. 327], the main stem at the base of each branch having a cankered appearance; the bark was loose and peeling, and sometimes the affected part was flat or sunken.

Coffee cuttings in frames affected by damping-off in many cases showed the presence of a species of *Rhizoctonia* which is one of the fungi causing the disease under cultural conditions more or less essential to the propagation of cuttings.

Hosking (H. R.) & Jameson (J. D.). **Botanical work, Serere.**—*Rep. Dep. Agric. Uganda, 1936–37* (Part II), pp. 84–103, 1938.

In further cotton-breeding trials in Uganda in 1936–7, the variety N. 17 was extraordinarily successful, its performance being unquestionably superior to that of S.G. 29, in spite of the low incidence of blackarm (*Bacterium malvacearum*) [*R.A.M.*, xvi, p. 235]. The high yield of S.P. 20 was maintained. S.P. 87 failed owing to late maturity, relapse from high blackarm resistance in the U. 4 trials, and unfavourable spinners' and brokers' reports. S.P. 84 did not give such a high yield as S.P. 20 but was better than S.P. 87 on all counts, obtaining consistently favourable spinners' and brokers' reports in a manner that has no parallel among U. 4 derivatives at Serere.

TAUBENHAUS (J. J.) & EZEKIEL (W. N.). **Relation of soil acidity to Cotton root rot.**—*Bull. Tex. agric. Exp. Sta.* 545, 39 pp., 1 fig., 1937. [Abs. in *Exp. Sta. Rec.*, lxxviii, 1, pp. 61–62, 1938.]

When *Phymatotrichum omnivorum* [*R.A.M.*, xvii, p. 172] was inoculated into cotton plants in adjacent containers filled with soils varying naturally in P_H value, the original incidence of root rot, its rate of spread, and its ability to overwinter were greater in the alkaline than in the acid soils. Further experiments indicated that only low percentages of infection or of overwintering occurred in soils more acid than P_H 5, whereas at P_H 8 to 8·5 high degrees of infection occurred and the disease killed many plants for years afterwards. Overwintering was not reduced by additions of manures, fertilizers, or trace elements. Cotton plants were more tolerant than was the fungus of soil alkalinity produced by additions of sodium carbonate. Relatively large amounts of sulphur when added to the less calcareous soils produced acidification, but also injured the roots, while lighter dressings were non-injurious and in some cases temporarily beneficial. The results obtained indicate, on the whole, that acid soils and those made acid chemically are less favourable to infection by *P. omnivorum* or to the continued survival of the fungus than alkaline soils or soils made alkaline.

STREETS (R. B.). **Phymatotrichum (Cotton or Texas) root rot in Arizona.**—*Tech. Bull. Ariz. agric. Exp. Sta.* 71, pp. 299–410, 36 figs., 2 graphs, 2 maps, 1937.

In this paper the author gives an account of root rot caused by *Phymatotrichum omnivorum* [*R.A.M.*, xvi, p. 672 and preceding abstract] on cotton and numerous other hosts. He states that the fungus has a host range of over 1,700 species of plants. The total annual losses in Arizona from root rots caused by this fungus are estimated at $500,000 as compared with $100,000,000 in Texas and $50,000,000 in six other affected States combined. The symptoms and the characteristics of the fungus are described. The most effective control measures are stated to be long-term rotations with non-susceptible crops (at least 3 years), clean cultivation, heavy applications of organic manure, a dressing of 4,350 lb. ammonium sulphate per acre followed by irrigation, soil disinfectants, barriers in the form of rows of non-susceptible crops or trenches filled with a mixture of soil and sulphur (2 to 4 per cent), waste oil, or crude carbolic acid, and surface applications of sulphur, on which experimental work is in progress. A bibliography of 157 titles is appended.

FAHMY (T.). **Giza 27, a wilt immune strain of long staple Cotton.**—*Bull. Minist. Agric. Egypt* 176, 13 pp., 12 diags., 1 chart, 1937.

A fully tabulated account is given of work carried out at Giza between 1928 and 1935 on the selection of a new strain of long staple cotton, Giza 27, immune from wilt [*Fusarium vasinfectum* var. *aegyptiacum*: *R.A.M.*, xv, p. 648]. The parents are Giza 7, a totally immune strain of good yield, high ginning yield and medium staple, and Sakla 3, a highly susceptible Sakel selection; both are of Egyptian origin. Full details are given of the method of selection, first for immunity [ibid., xiii, p. 632], and then for quality, up to the F_8 generation,

with the results of spinning and chequer trials. The strain was found to have a better lint quality but a lower yield than Giza 7, with a heavier yield than Sakla 3.

While it is not yet possible to say whether Giza 27 will be introduced to the market or not, the story of its production is considered to warrant publication at this stage, when the scientific part of the work is complete.

Neal (D. C.). **Crinkle leaf, a new disease of Cotton in Louisiana.**—*Phytopathology*, xxvii, 12, pp. 1171–1175, 2 figs., 1937.

A new cotton disease, described as 'crinkle leaf', is prevalent in certain localized areas on Lintonia and Olivier silt loam ('bench' or 'bluff') soils in Louisiana, where it was first observed in 1934 by H. B. Brown, of the Agricultural Experiment Station. Several upland varieties are affected, including Half and Half, Clevewilt, Express, Dixie-Triumph, Deltapine, and a Sea Island×Upland hybrid. The leaves are puckered, mottled, semi-chlorotic, and distorted in the early stages; subsequently necrotic lesions develop along and between the veins, and approaching maturity is accompanied by thickening, brittleness, and marginal raggedness. The branches are usually fasciated, though apparently normal ones sometimes arise from the basal nodes of the diseased main stem. The involucral bracts, floral buds, flowers, and bolls are abnormally small and often markedly asymmetric, the bracts and bolls also being deficient in chlorophyll. Distorted bolls mature very irregularly, producing weak fibre and almost worthless lint. The cortical, pith, and vascular tissues of the terminal branches are imperfectly developed and the normal metabolism of the plant thereby greatly impeded. 'Crinkle leaf' presents certain analogies with previously reported abnormalities, including crazy top [*R.A.M.*, xiv, p. 629] and inherited 'round' or 'crinkly' leaf, from which it differs, however, in various distinctive features and in the manifest absence of any hereditary tendency. Inoculation experiments and attempts to transmit the disorder by grafting gave negative results, but symptoms similar to those described above have been observed on greenhouse cotton plants grown in steam sterilized Lintonia silt loam soil.

Charobim (W. M.). **Moisissure noire des cocons Aspergillus phoenicis (Corda).** [Black mould of cocoons, *Aspergillus phoenicis* (Corda).]—*Bull. Minist. Agric. Egypt* 185, 5 pp., 5 pl., 1937.

Details are given of the writer's experiments showing that the black mould of silkworm cocoons, due to *Aspergillus phoenicis* [*R.A.M.*, x, p. 184], can only infect the dead chrysalids (killed either by five hours' exposure to sunshine or 15 minutes' at a temperature of 80° C., which is not sufficient to kill the spores) in the presence of sufficient humidity to permit of spore development. Complete desiccation of the cocoons was obtained by exposure to sunshine for six hours a day during a period of eight days, and no trace of infection was found in the group thus treated.

Petch (T.). **Isaria exoleta Fr.**—*Naturalist, Lond.*, pp. 250–251, 1936. [Received December, 1937.]

In July, 1936, the author received from Tadcaster, on a Lepidopterous pupa, a *Hirsutella* with phialides 20 to 40 μ high with an inflated, usually flask-shaped, but often irregular base measuring 12 to 18 by 5 μ and attenuated above into a stout sterigma up to 20 μ long. These organs were arranged singly or in clusters at the apices of short hyphae 4 μ in diameter, giving the clava a granular appearance under a low magnification. The oval or lemon-shaped spore cluster measured 10 by 7 μ, and the individual, hyaline, cymbiform conidia had rounded ends and measured 9 by 2·5 μ. Seen by transmitted light, the exterior layer of the solid core of the clava was fuliginous. Two further specimens were found at Hubberholme in September, 1936, under moss on rocks. The fungus was found to be identical with *Isaria exoleta* Fr. and *Cordyceps fuliginosa* Ces., which was a conidial form, not a *Cordyceps*. It is renamed *H. exoleta* comb. nov.

Couch (J. N.). **The formation and operation of the traps in the nematode-catching fungus, Dactylella bembicodes Drechsler.**—*J. Elisha Mitchell sci. Soc.*, liii, 2, pp. 301–309, 1 pl., 1937.

An account is given of the author's studies on *Dactylella bembicodes* [*R.A.M.*, xvii, p. 36] in pure culture on a variety of media. On moist wood or in aqueous solutions containing nematodes, the fungus forms, on short 2-celled stalks, numerous small rings or loops, each consisting of three cells, the apical one of which anastomoses with the basal cell and with the top cell of the stalk. The loops measure 24 to 31 μ in outside and 16 to 21 μ in inside diameter. Such rings are also produced on certain nutrient agars and when the food material is reduced. On media on which no rings were formed, e.g., maltose peptone agar, their formation was induced by acidifying the substratum to a certain degree or by adding to it a drop of the brownish water from the original dish containing the fungus and nematodes. Direct observations under the microscope showed that when a nematode thrusts its head or tail into one of the rings, the latter closes practically instantaneously by the simultaneous swelling of the three cells of the loop. Partial closure of the rings was induced by inserting a fine glass rod and moving it back and forward in the loop, and a slight swelling of the cells in a few rings was stimulated by a 1 per cent. lactic acid solution. Complete and instantaneous closure was obtained by the application of dry heat to the surface of the culture or by the addition of a drop or two of water at a temperature between 33° and 75° C.; water above 80° failed to induce closing of the loops, the cells being killed. While there is no apparent relation between the results of these experiments and the closure induced by the 'cold-blooded' nematodes, it is assumed that a chemical substance is given off by the latter, which causes the colloids inside the loop cells to swell. After capture the nematode is rapidly destroyed by the fungus, and the possibility is suggested of using the organism for the biological control of soil-inhabiting nematodes.

TIFFNEY (W. N.) & WOLF (F. T.). **Achlya flagellata as a fish parasite.**—*J. Elisha Mitchell sci. Soc.*, liii, 2, pp. 298–300, 1937.

The authors state that *Achlya flagellata* [*R.A.M.*, xi, p. 397] was found in 1935 attacking a newt (*Triturus viridescens*), in association with *Saprolegnia parasitica* [ibid., xvi, p. 745] in a small pond near Lexington, Massachusetts, and was further isolated alone from 12 out of 70 fish (*Lebistes reticulatus*) which were kept for experimental purposes in an aquarium tank at Cambridge, Massachusetts; all the infected fish died eventually. The organism isolated from the latter was then shown experimentally to be pathogenic to other fish (*Fundulus heteroclitus*), slightly injured by the removal of a few scales, 9 out of 25 individuals in the infected tank dying. During the early summer of 1936 *A. flagellata* was responsible for the death of about 50 per cent. of fingerlings of the brook trout (*Salvelinus fontinalis*) in Bayfield Hatchery, Wisconsin, but fingerlings of the brown trout (*Salmo fario*) and rainbow trout (*S. irideus*) in the same hatchery appeared to be almost immune from it. It appears, therefore, that under Wisconsin conditions *A. flagellata* may at times become a destructive parasite of fish.

CASTELLANI (A.). **A preliminary report on two pathogenic fungi: Trichophyton dankaliense n.sp., and Sporotrichum anglicum n.sp.**—*J. trop. Med.* (*Hyg.*), xl, 24, pp. 313–318, 3 pl. (1 col.), 11 figs., 1937.

From a piece of camel skin submitted for examination by the Plant and Animal Products Department of the Imperial Institute the author isolated a species of *Trichophyton* forming rust- to orange-red cultures on glucose agar, peptonizing milk, liquefying gelatine, and serum, but elaborating neither acid nor gas from the various sugars and carbohydrates tested, with the possible exception of arbutin. The fungus was grown on a number of other standard media, of which potato agar and carrot slants induced the most characteristic mode of development. Hanging-drop cultures on peptone water and physiological saline solution showed the presence of hyphae ranging from 2 to 4·5 μ in diameter, ellipsoid, oval, or rounded, mostly intercalary chlamydospores, occasional oval, piriform, or roundish aleuriospores, roundish, double-contoured cells, isolated or in groups, sometimes enclosed in a very delicate sac and possibly representing asci with ascospores, and 'fuseaux', mostly 4- to 6-celled and in some cases falciform and reminiscent of *Fusarium* spores. A superficial resemblance to *Microsporon ferrugineum* [*R.A.M.*, xvi, p. 747] is apparent in the species under discussion, which does not, however, produce vermiculoid colonies or form pectinate bodies. The camel-skin fungus, which appears to be identical with an organism isolated by the writer during the Abyssinian campaign from two native camel attendants suffering from ringworm, is provisionally named *T. dankaliense* n.sp.

Sporotrichum anglicum n.sp., isolated from two cases of chronic bronchitis (once in association with *Monilia* [*Candida*] *pseudotropicalis*), makes good growth on glucose agar and other laboratory media, e.g. potato and carrot. On the first-named the colonies are whitish or

greyish, rugose, and covered with a very short, white 'duvet'. In hanging-drop cultures the abundant hyphae, sometimes furnished with many lateral denticules, range from 2 to 4 μ in diameter, and the numerous single or aggregated, oval conidia, borne on minute pedicels, average 4·6 by 3·5 μ, though the maximum longitudinal diameter may be only 3 μ in some cases and 7 μ in others. The fungus is Gram-positive, does not liquefy gelatine or serum or coagulate milk, but produces acid and gas from glucose and levulose and frequently also from maltose and saccharose, thereby differing from all other known species of *Sporotrichum*.

KANO (K.). **Über die Chromoblastomycose durch einen noch nicht als pathogen beschriebenen Pilz: Hormiscium dermatitidis n.sp.** [On chromoblastomycosis due to a fungus not hitherto described as pathogenic, *Hormiscium dermatitidis* n.sp.]—*Arch. Derm. Syph., Berl.*, clxxvi, 3, pp. 282–294, 5 figs., 1937.

Hormiscium dermatitidis, the agent of a facial dermatomycosis simulating tuberculosis verrucosa cutis in a 28-year-old Japanese woman [*R.A.M.*, xv, p. 502], was obtained in pure culture on 4 per cent. maltose agar and other media, producing on the former dull, coal-black, faviform colonies attaining a diameter of 8 mm. in 40 days and resembling mulberries in their protuberant shape and finely granular or plicate surface. In hanging-drop cultures on glucose peptone agar at 30° C. the fungus forms chains of variable shape, mostly consisting of ten or more oval (8 to 12 by 4 to 7 μ), round (10 μ in diameter), or elongated (5 to 12 or up to 20 by 3 to 5 μ) cells. Gemmae are present, mostly composed of round, thick cells with more slender, longer young cells at their apices. Bi- or occasionally trifurcate branching may take place apically, laterally, or at the junction of two cells. The rudimentary mycelia (best observed on a carrot medium) consist of more than ten segments of cells measuring 6 to 8 by 2 to 3 μ. The optimum temperature for the growth of the fungus is 20° to 30°, deterioration occurring at 37° and cessation at 43°. Animal and auto-inoculation experiments gave positive results.

FLINN (R. S.) & FLINN (J. W.). **Bronchomoniliasis.**—*J. trop. Med.* (*Hyg.*), xl, 20, pp. 237–240, 4 figs., 1937.

Bronchomoniliasis [*R.A.M.*, xvii, p. 111], a widespread disease in the United States and elsewhere, is often not recognized, owing to confusion of the symptoms with those of pulmonary tuberculosis. Details are given of two cases associated with the presence in the sputum of *Monilia* [*Candida*] *pinoyi* [ibid., xvi, p. 811], and the opinion is expressed that the occurrence of this organism in the mouth is abnormal and calls for careful investigation.

WEEDON (F. R.), KENNEY (DOROTHY), & SHIRK (MARIE E.). **The incidence of Monilia albicans in routine sputum specimens.**—Abs. in *J. Bact.*, xxxiv, 6, pp. 657–658, 1937.

In view of the accepted association of *Monilia* [*Candida*] *albicans* [*R.A.M.*, xvi, p. 748; xvii, p. 111] with inflammatory lesions in various sites, data were collected on the incidence of the yeast in the sputa

of 55 patients presenting symptoms of chronic pulmonary involvement. Of these specimens five contained *C. albicans*, and an extended series of similar observations is planned to determine the significance of this high incidence in relation to the clinical features of the associated pathological conditions.

GJESSING (H. C.) & MOSSIGE (K.). **Epidermophytosis: report of cases in three brothers, one of whom showed a hitherto undescribed clinical type on the scalp.**—*Arch. Derm. Syph., Chicago*, xxxvi, 6, pp. 1154–1157, 3 figs., 1937.

Epidermophyton inguinale [*E. floccosum*: *R.A.M.*, xvi, pp. 748, 810; xvii, p. 38] was isolated in Oslo, Norway, from the right foot, left ear, and scalp of one of three brothers, all of whom were suffering from various forms of epidermophytosis. If, as appears to be the case, the fungus was responsible for the extensive diffuse pityriasis observed, a new clinical type of the disease should be recognized under the name of pityriasis epidermophytica diffusa.

MORIKAWA (T.). **Granuloma trichophyticum Majocchi, hervorgerufen von Sabouraudites ruber (Castellani) (Trichophyton purpureum Bang).** [Granuloma trichophyticum Majocchi, caused by *Sabouraudites ruber* (Castellani) (*Trichophyton purpureum* Bang).]—*Arch. Derm. Syph., Berl.*, clxxvi, 3, pp. 265–281, 6 figs., 1937.

A full clinical, histological, and experimental discussion is given of a case of granuloma trichophyticum Majocchi, in a 29-year-old peasant woman. It is stated to be a very rare disease of which this is the first record in Japan. Two strains of the causal organism, *Trichophyton purpureum* [*R.A.M.*, xvi, p. 748] were isolated, one (A) from areas of superficial infection representing the typical form, and another (B) from deeper-lying sites, characterized by ill-developed, faviform cultures in which neither aleuria nor spindle spores were formed. Only the latter strain, together with *T. violaceum* [ibid., xvii, p. 38] and *T. faviforme album* [*T. album*: ibid., xvii, p. 244], was capable of inducing the characteristic deep granulomata in the patient and in laboratory animals, A causing only superficial trichophytosis.

SCHOOP (G.). **Salzpilz (Torula epizoa) auf Lebensmitteln.** [The salt fungus (*Torula epizoa*) on foodstuffs.]—*Dtsch. tierärztl. Wschr.*, *1937*, pp. 621–624, 1937. [Abs. in *Zbl. Bakt.*, Abt. 1 (Ref.), cxxviii, 9–10, p. 238, 1938.]

Torula epizoa [cf. *Sporendonema epizoum*: *R.A.M.*, xiii, p. 700], an obligate halophyte, was found forming rust-coloured to blackish-brown deposits on dried fish, bacon, ham, and sausages at the State Laboratory for Veterinary Analysis, Cassel (Germany). The best culture medium proved to be salt fungus agar plus 10 per cent. sodium chloride. Salt requirements and pigmentation vary in different strains of the mould.

GISSKE (H. W.). **Über die für die Verderbnis von in Kühlhäusern eingelagerten Eiern wichtigen Schimmelpilze unter besonderer Berücksichtigung des Schimmelpilzgehaltes der Kühlhausluft.** [On the moulds of importance in the spoilage of eggs in cold

storage, with special reference to the mould content of the atmosphere.]—Vet.-med. Diss., Hanover, 1937. [Abs. in *Zbl. Bakt.*, Abt. 1 (Ref.), cxxviii, 9–10, pp. 239–240, 1938.]

The following 11 moulds were detected in the atmosphere of a refrigerator used for the storage of eggs [cf. *R.A.M.*, xiv, p. 237] in Germany: *Penicillium glaucum*, *Cladosporium herbarum*, *Mucor racemosus*, *M. mucedo*, *Thamnidium elegans*, *Rhizopus elegans*, *Chaetostylum fresenii*, *P. brevicaule*, *M. pusillus* [ibid., xv, p. 297], *Verticillium* sp. [cf. ibid., xi, p. 641], and *Aspergillus candidus*. All species made macroscopically visible growth in three to five days at room temperature, but in the incubator *R. elegans* and *M. pusillus* were the only ones found to be viable after five days. Of seven species held at −2° C. *P. glaucum*, *M. racemosus* [ibid., xiii, p. 702], and *T. elegans* were still growing after 30 days. Bephol soap, a liquid disinfectant, applied to the cultures or sprayed through the atmosphere, was effective only against *P. glaucum*, *Cladosporium herbarum*, and *R. elegans* after two, three, and five days, respectively. *P. glaucum* and *M. racemosus* were the only species out of six grown in the presence of carbon dioxide to make slight growth after four days. Further experiments involving the exposure of fresh eggs to direct contamination by various atmospheric moulds showed that spoilage is mainly due to *P. glaucum*, *C. herbarum*, and *P. brevicaule*.

Rainio (A. J.). **Anthraknose der Agaven erzeugt durch Gloeosporium fructigenum Berk. (Colletotrichum agaves Cav. = Gloeosporium agaves Syd.)—Glomerella cingulata (Stonem.) Spauld. & Schr.** [Anthracnose of Agaves caused by *Gloeosporium fructigenum* Berk. (*Colletotrichum agaves* Cav. = *Gloeosporium agaves* Syd.)—*Glomerella cingulata* (Stonem.) Spauld. & Schr.]—*Valt. Maatalousk. Julk.*, 96, 20 pp., 2 pl., 1937. [Finnish summary.]

Agave americana plants transferred to a cool greenhouse (5° to 18° C.) at Helsingfors in the autumn of 1935 were observed to be affected by a disease terminating in foliar chlorosis and dying-off of the plants. The under, and later also the upper leaf surfaces bore dark green spots, turning brownish and finally dirty grey with age. The lesions (produced also by artificial inoculation) were covered only by the convex cuticle of the leaf, the eventual rupture of which liberated aggregations of conidia of a fungus which agreed with the published descriptions of *Colletotrichum agaves* [*R.A.M.*, vi, p. 341].

On oat agar no setae were formed, and the fungus presented the characters of a *Gloeosporium*; no doubt the occasional absence of these organs in nature led to Sydow's classification of the fungus as *G. agaves* (Index universalis, 1898). On meat broth agar, however, setae were produced. It is apparent that setae are not an integral part of the fungus but develop in response to certain nutritional factors; hence they cannot properly be used to transfer the organism from *Gloeosporium* to *Colletotrichum*, and pending further studies (which might involve a reclassification in the genus *Trullula* on the basis of the concatenate conidia) the use of the name *G. agaves* is recommended. After numerous unsuccessful attempts, the formation of the perfect

stage of *G. agaves* was induced by the inoculation of pure cultures on oat agar with a suspension of *Pseudomonas hyacinthi*. The perithecial stage would appear to belong to *Glomerella cingulata*.

Myers (W. M.). **The nature and interaction of genes conditioning reaction to rust in Flax.**—*J. agric. Res.*, lv, 9, pp. 631–666, 3 pl., 1937.

After briefly referring to Flor's recent paper on physiologic specialization in *Melampsora lini* (*J. agric. Res.*, li, pp. 819–837, 1935) [cf. also *R.A.M.*, xv, p. 804], the author gives a tabulated account of field and greenhouse investigations from 1934–6, inclusive, in Minnesota, in an attempt to determine the nature and mechanism of inheritance in flax of reaction to physiologic form 4 of flax rust (received from Flor), and to a collection of the rust obtained at University Farm, Minnesota. The test material consisted of 37 crosses involving 17 varieties and strains of flax, which were experimentally shown to vary from complete immunity both in the field and in the greenhouse (Ottawa 770 B, Newland, C.I. 188, Minnesota, C.I. 438, and one strain of Bolley Golden) to susceptible (Pale Blue and Abyssinian Yellow); C.I. 649 gave a mixed reaction varying from resistant to semi-resistant. The immunity of Ottawa 770 B in the field was conditioned by a single dominant factor. In general, the reaction of all the hybrids studied to form 4 and to the rust collection was similar, immunity being dominant to near immunity, resistance, and susceptibility, and resistance being dominant to semi-resistance and susceptibility. The behaviour of the hybrids of Ottawa 770 B, Newland, C.I. 438, C.I. 416–3, and C.I. 712 is explained by assuming factors in two different allelic series, L and M. These are duplicate factors conditioning immunity; l^n and m^n condition near immunity, l^n being allelic to L and m^n allelic to M; l^r and m^r condition resistance, l^r being allelic to L and l^n, and m^r allelic to M and m^n. On this hypothesis, the genotype of Ottawa 770 B is $LL\ mm$; Newland, $ll\ MM$; C.I. 438, $LL\ m^rm^r$; C.I. 416–3, $ll\ m^nm^n$; and C.I. 712, $l^rl^r\ mm$. The probable genetic constitution of the other flax varieties involved in the crosses is further discussed on the same lines.

Jenkins (Anna E.). **Coryneum microstictum on Rose from Oregon.**—*Mycologia*, xxix, 6, pp. 725–731, 2 pl., 1937.

The results of the author's comparative morphological and cultural studies of *Coryneum microstictum* on rose from Oregon [*R.A.M.*, xiv, p. 172] showed that its conidial measurements were essentially the same as those on rose from the eastern part of the United States, but were somewhat larger than those from Canada and England. In pure culture the Oregon fungus differed from the eastern one only in its colour, and was also similar to an authentic culture of *C. microstictum* var. *mali*. The conidia produced by the two United States strains in pure culture were often larger than those produced in nature, sometimes containing as many as seven cells. Two strains of *C. beijerinckii* [*Clasterosporium carpophilum*] (from Oregon and Europe, respectively) were also included in the studies; the one from Oregon in pure culture produced few-celled and relatively short conidia, whereas in the one from Europe the conidia were usually longer and sometimes up to seven-celled.

Prevention of Antirrhinum rust.—*Egypt. Mail, 1937*, 7956, 1937.

Preliminary experiments carried out by the Mycological Section of the Ministry of Agriculture, Egypt, indicate that *Antirrhinum* [*majus*] rust [*Puccinia antirrhini*] may be controlled in that country [*R.A.M.*, xvi, p. 387] by spraying with 0·5 per cent. colloidal sulphur and 0·25 per cent. household soap, the first application to be made immediately symptoms of infection appear and the treatment to be continued at two- to three-weekly intervals throughout the season. Either the Avon (W. J. Craven & Co.) or sulsol brands of colloidal sulphur may be used.

Gadd (C. H.). **A disease of Salvias.**—*Trop. Agriculturist*, lxxxix, 6, pp. 335–338, 1 pl., 1937.

The results of experiments briefly described in this paper showed that disease symptoms on *Salvia farinacea* in Ceylon, suggestive of virus infection, are caused by attacks of a Capsid bug (*Lygus viridanus*).

West (E.). **Witches' broom of Oleander.**—*Pr. Bull. Fla agric. Exp. Sta.*, 2 pp., 1937.

Witches' broom of oleander (*Nerium oleander*) in Florida is caused by a species of *Sphaeropsis*. The brooms originate in buds on the stem, and when several of the larger canes are attacked the bush assumes a stunted appearance and ceases to produce flowers. The fungus, which is not apparent in living brooms, now produces numerous black pustules near the bases of the small dead twigs. The pustules in due course exude large numbers of minute, oval, black spores. Control measures recommended consist in the pruning out of all brooms, including 12 in. of the branches on which they were growing, followed by the application of some good copper fungicide equivalent to Flordo spray [*R.A.M.*, xvii, p. 51] or 3–3–50 Bordeaux mixture. The prunings should be carefully collected and burned to prevent the dispersal of spores.

Ferraris (T.). **Un Oidio su la Stapelia europaea Guss. (Oidium acrocladum Ferr. n.sp.).** [A species of *Oidium* parasitic on *Stapelia europaea* Guss. (*Oidium acrocladum* Ferr. n.sp.).]—*Boll. Lab. sper. R. Oss. Fitopat. Torino*, xiv, 1–4, pp. 41–44, 2 figs., 1937.

A description [with Latin diagnosis] is given of a species of *Oidium* considered to be new to science and named *O. acrocladum*, which in 1937 was observed in a glasshouse near Verrua Savoia, Piedmont, causing a white soft rot of the young stem tips of potted plants of *Stapelia europaea*. The fungus forms globose haustoria, unbranched, septate conidiophores measuring 100 to 110 by 7 μ, and conidia in long chains, the apical one oval, rounded, 29 to 31 by 17 to 19 μ, and the remainder truncate at both ends, 21 to 24 by 12 to 14 μ.

Taubenhaus (J. J.) & Altstatt (G. E.). **A decay of ornamental Cacti caused by Aspergillus alliaceus.**—*Mycologia*, xxix, 6, pp. 681–685, 1 pl., 1937.

An account is given of a serious outbreak in 1933 of a rot of the cladodes of ornamental cacti in south-west Texas, caused by *Asper-*

gillus alliaceus [*R.A.M.*, xiii, p. 559], this being apparently the first record of the organism causing a decay of cultivated plants in the United States. Inoculation experiments indicated that *A. alliaceus* was pathogenic to the cacti, and also to several species of mature fruits and vegetables, only when the spores or the sclerotia were introduced through needle punctures. Effective control was obtained by spraying with Bordeaux mixture.

JENKINS (ANNA E.). **Distribution of Rose anthracnose in California.**—*Plant Dis. Reptr*, xxi, 17, pp. 316–317, 1 pl., 1 map, 1937. [Mimeographed.]

Rose anthracnose (*Sphaceloma rosarum*) [*R.A.M.*, xii, p. 95; xiii, p. 493; xiv, p. 678] is reported to have occurred at San Diego, California, severely attacking the Silver Moon variety, about the year 1932, and a little later at Guadeloupe, Santa Barbara county. In 1937, it occurred on dooryard and garden roses in several other localities in California, namely Riverside, San Marino (where the George Arends variety was severely affected, the lesions attaining a diameter of 7 mm.), San Francisco, Klamath, and Crescent City. In most of the new localities except San Marino it was practically the only disease in evidence.

Rust on Marigold in California.—*Plant Dis. Reptr*, xxi, 20, p. 374, 1937. [Mimeographed.]

African marigolds (*Tagetes erecta*) at San Juan, California, were found by J. B. Kendrick and M. W. Gardner to be affected by a rust, identified by Dr. G. B. Cummins as *Coleosporium madiae* Cke. There appears to be no previous record of a *Coleosporium* on *Tagetes*.

KLINKOWSKI (M.). **Pilzkrankheiten und nichtparasitäre Schädigungen der Luzerne.** [Fungous diseases and non-parasitic injuries of Lucerne.]—*Kranke Pflanze*, xiv, 12, pp. 201–205, 1937; xv, 1, pp. 6–9, 2 pl., 1938.

Semi-popular notes are given on a number of fungous and non-parasitic diseases affecting lucerne in Germany [cf. *R.A.M.*, xvi, p. 816], including white stippling [ibid., xii, p. 765], a disturbance in water relations due to frost or potash deficiency; downy mildew (*Peronospora aestivalis*) [*P. trifoliorum*: see above, p. 301]; mosaic [ibid., xvi, pp. 113, 518]; leaf spots (*Pseudopeziza medicaginis* [ibid., xvii, p. 44], *Macrosporium* [*Thyrospora*] *sarcinaeforme* [ibid., xvi, p. 754], *Ascochyta medicaginis* [ibid., xi, p. 654], *Pyrenopeziza medicaginis* [*Pseudopeziza jonesii*: ibid., xiv, p. 494], and *Septoria medicaginis* [ibid., vi, p. 101]); rust (*Uromyces striatus*) [loc. cit. and ibid., xvii, p. 44]; true mildew (*Ersyiphe pisi* f. sp. *medicaginis-sativae*); hollow crown, probably due in the first place to mechanical breakage of the stem intensified by frost damage; stem rot (*Sclerotinia ciborioides*) [*S. sclerotiorum*: ibid., xvii, p. 252]; wilt (*Fusarium* [? *trifolii*: ibid., xvi, p. 754]), occurring in a severe form chiefly during the heat of summer and in warm, dry situations; crown wart (*Urophlyctis alfalfae*) [ibid., xvi, p. 563]; anthracnose (*Colletotrichum trifolii*) [ibid., xiii, p. 382; xvii, p. 44], a recent introduction into the country which is

assuming a virulent character; and violet root rot (*Rhizoctonia crocorum*) [*Helicobasidium purpureum*: ibid., xvii, p. 44].

WATERHOUSE (W. L.). **A note on the ascigerous stage of Claviceps paspali S. & H. in Australia.**—*Proc. Linn. Soc. N.S.W.*, lxii, 5–6, p. 377, 1937.

In 1935 a serious outbreak of ergot (*Claviceps paspali*) [*R.A.M.*, xvi, p. 36] occurred in south-eastern Australia on *Paspalum dilatatum* and other species of *Paspalum*, the sphacelial and sclerotial stages being observed throughout the area, though the ascigerous stage has not previously been reported in Australia. Mature sclerotia from *P. dilatatum* were collected in March 1936, sown on the surface of soil in pots, and covered lightly with sand and plant debris, afterwards being alternately frozen [cf. ibid., xvii, p. 104] and thawed until September, after which the pots were kept on the floor of a plant house and the soil occasionally watered. The first signs of germination were noted in October, 1937, and the production of the perfect stage had continued profusely since that date. There would appear to be no reason why natural weathering should not bring about the production of the perfect stage of *C. paspali* in the field. Ascospore production in nature may perhaps be an important factor in dissemination and in giving rise to new physiologic races.

CHRISTOFF (A.). Вируснитѣ болести по овощнитѣ дървета. [Virus diseases of fruit trees.]—*Publ. Bulg. Pl. Prot. Service* 29, 23 pp., 21 figs., 1937.

This is a very popular account, specially written for the information of the local small growers, of the chief virus diseases of fruit trees and shrubs in Bulgaria, most of which have already been noticed in this *Review* from other sources.

PLAGGE (H. H.) & MANEY (T. J.). **Factors influencing the development of soggy breakdown in Apples.**—*J. agric. Res.*, lv, 10, pp. 739–763, 6 figs., 1 graph, 1937.

The authors report the effects of storage temperature, picking maturity, short and long pre-storage delays, and aeration on soggy [low temperature] breakdown in apples [*R.A.M.*, xvi, p. 688], according to the results of their observations carried out over eleven years in Iowa. Apple varieties from the same orchard in different years and from different orchards in the same year exhibit marked differences in susceptibility to soggy breakdown. The optimal storage temperature for Jonathan, Northwestern Greening, Wealthy, Winter Banana, Golden Delicious, and Grimes Golden appears to be 36° F. Jonathan proved to be less susceptible to soggy breakdown when rather overmature on the picking date, but the contrary is true for the Northwestern Greening. It is suggested that susceptibility is associated with the stage of respiratory activity attained by the fruit at the time it is placed in storage.

Prompt storage after picking causes greater susceptibility in Jonathan, Northwestern Greening, and Winter Banana and greater resistance in Grimes Golden, Wealthy, and Golden Delicious. Long delays

of 5 to 10 weeks at 50° before storing produced a marked resistance in Jonathan, Grimes Golden, Winter Banana, Northwestern Greening, and, to a less degree, in Golden Delicious.

Aeration in storage of wrapped fruit packed in boxes or unwrapped fruit in wire baskets proved to be an unsatisfactory means of control for soggy breakdown. Colour and size of fruit appear to influence the susceptibility only to a very small extent; Jonathan with 100 per cent. colour in storage at 30° is less resistant than fruit of the same maturity with only 25 to 50 per cent. colour; Northwestern Greening of a full yellow colour is less resistant than leaf-green fruit. In most of the tested varieties of apples the size of the fruit is of little consequence, except for Northwestern Greening, large fruits of which appear to be more susceptible to soggy breakdown than small.

A rather definite period of development of soggy breakdown is indicated, ranging from about 12th December to 15th February in Grimes Golden, and from 15th November to 1st February in Jonathan.

THOMAS (P. H.). **Treatment of tree wounds.**—*Tasm. J. Agric.*, N.S., viii, 4, pp. 180–184, 4 figs., 1937.

The writer states that *Polystictus versicolor* [*R.A.M.*, xvi, p. 106] is a prevalent wound parasite in Tasmanian orchards. It attacks mature trees more severely than young ones, kills the bark and cambium, and causes serious injury.

Recent experiments on apple trees have shown that treatments with bitumen emulsion [ibid., xvii, p. 187] and glycerine-mercuric compounds (glycerine 3 qts., water 1 qt., mercuric chloride and cyanide $\frac{1}{4}$ oz. each) give the most satisfactory control. The experimental treatments were applied towards the end of the dormant period (August 1935) before the commencement of spring growth. The glycerine-mercuric mixture was applied to wounds after the excision of diseased tissue and trimming. Two applications at an interval of about 21 days proved successful even in the worst cases.

MORWOOD (R. B.). **Little leaf of the Apple.**—*Qd agric. J.*, xlviii, 6, pp. 673–678, 4 figs., 1937.

Zinc injections into the shoots of apple trees in Queensland affected by little leaf [*R.A.M.*, xvi, pp. 682, 817] having stimulated a slight but favourable response, a further test was made in which affected and unaffected Lalla and Jonathan apple trees were given an autumn application of a mixture consisting of 10 lb. zinc sulphate and 5 lb. hydrated lime per 100 galls. water, an average amount of 4/5 gall. being given per medium-sized tree. The following spring the sprayed Lalla trees were observed to show much healthier growth than the unsprayed controls; of the sprayed trees only the portions most severely affected during the previous season had failed to show complete recovery, while in the unsprayed plots trees previously affected showed more severe symptoms, and many hitherto unaffected trees showed a considerable amount of little leaf. Some evidence of control was observed in Jonathan. As even one year's delay in the application of control measures may be attended by serious results, growers are advised to spray their trees while in full leaf with a mixture made by

dissolving 8 lb. commercial zinc sulphate in about 70 galls. water and adding 4 lb. hydrated lime dissolved in 4 galls. water while stirring, the mixture then being made up to 80 galls.

KIENHOLZ (J[ESS] R.) & CHILDS (L.). **Twig lesions as a source of early spring infection by the Pear scab organism.**—*J. agric. Res.*, lv, 9, pp. 667–681, 1 fig., 5 graphs, 1937.

The authors state that observations in 1934 and 1935 in the Hood River Valley of Oregon, where pear scab (*Venturia pirina*) [*R.A.M.*, xvi, p. 797] has become a serious limiting factor in the production of pears since 1932, indicated, in agreement with R. W. Marsh's findings in England [ibid., xiii, p. 36], that the number of primary infections on pear trees early in the spring is closely correlated with the amount of twig infections in the orchard. In 1934, which was marked by a long and dry growing season, most of the lesions occurred at the base of the current season's twigs, indicating that infection had taken place soon after they started growth; such lesions were sloughed off or became inactive before the trees became dormant, and the majority failed to produce conidia the following spring. During years with shorter growing seasons and more rainfall, the pear trees appeared to be unable to slough off incipient infections, with the result that practically all the lesions remained active and produced spores the next spring. These data were confirmed by observations on the effects of spraying during four years in commercial orchards, which showed that where twig infections were absent, pear scab was relatively easy to control, even in the presence of plentiful ascospores (detected by spore traps) from overwintered leaves. The fact that conidia were found to be dispersed before bud tissues are exposed, causing twig infections before the ascospores are mature, indicates that early sprays should be timed by conidial dispersion from twig lesions, where these occur. It was further shown that consistent and thorough spraying during the growing season largely prevented twig infections, and that in the district surveyed early season applications were more important for the control of both twig and fruit scab, because more precipitation occurred early in the season, and because a certain amount of host resist ancebecame apparent after that time. Lime-sulphur was effective in 'burning out' active twig pustules, but was injurious to young, tender-skinned fruits, for which reason it was dangerous if applied after the bud scales had dropped; when applied in the delayed-dormant stage, however, it allowed additional sprays to give satisfactory control against reinfection by keeping down the number of primary spores.

KEITT (G. W.), BLODGETT (E. C.), WILSON (E. E.), & MAGIE (R. O.). **The epidemiology and control of Cherry leaf spot.**—*Res. Bull. Wis. agric. Exp. Sta.* 132, 117 pp., 7 figs., 21 graphs, 1937.

Field, laboratory, and greenhouse studies, carried out in Wisconsin since 1914 with only two seasons' intermission, on the leaf spot (*Coccomyces hiemalis*) of sour cherry (*Prunus cerasus*) [*R.A.M.*, xvi, pp. 544, 696] are described in detail with special reference to its development and control in relation to environmental factors and its prevention under partially controlled conditions. On agar gel in Petri dishes the

conidia failed to germinate in 48 hours at 4° C., germination being very sparse at 8°, and greatly retarded at 12°, best at 16° to 28°, and falling off rapidly to the upper limit of about 32°. Germ-tube elongation was quickest at 20° to 28°. Nearly 50 per cent. ascospore germination occurred at 4° in 48 hours, germ-tube elongation being greatly retarded at 4° and 8°, much quicker at 12°, and greatly favoured by temperatures of 16° to 28°. Ascospore germination was slight at 30° and totally inhibited at about 32°. Continuous wetting was the best moisture relation for spore germination, and little resistance was shown to desiccation after germination.

When potted Montmorency cherries were artificially infected with conidia in the greenhouse initial infection was expedited by the following temperatures in decreasing order: 20°, 16°, 24°, 12°, 28°, and 8°. Most of the lesions became macroscopically visible in 5 to 8 days at 20° or 28° and in 8 to 11 days at 12°. The amount of infection that developed was much reduced when the moist period after inoculation was broken by air-drying the plants for brief periods after spore germination had begun, but before major infection took place. Considerable infection was initiated in darkness or diffused light, but the amount of infection was not greatly influenced by 'length of day' or intensity of illumination. Prolonged darkness before and after infection reduced the incidence of the disease. Very young leaves were resistant, but became susceptible when the folded halves began to separate, and mature leaves were highly susceptible.

Isolates from *P. cerasus*, *P. avium*, and *P. mahaleb* cross-infected freely on these hosts, but isolates from *P. cerasus* and *P. pennsylvanica* did not cross-infect readily. No wild host appears to play any significant part as a source of inoculum locally. The only known type of natural overwintering is in the dead leaves as stroma-like bodies containing ascocarp initials. Ascospores appear to be the only important primary inoculum under natural conditions in Wisconsin, though apothecial conidia were found. Ascospore discharge took place only when the leaves were thoroughly wet, and became most copious after they began to dry. Very sparse at 1°, 4°, and 8°, it was rapid at 16° and over. Natural discharge generally began before blossoming and lasted six or seven weeks. Primary infection was sparse and its chief epidemiological importance was to re-establish the fungus on the host. Abundant conidial production followed infection under all conditions except high temperatures. No functional acervuli developed on plants held continuously at 28°. The lower temperatures at which lesions developed favoured sporulation and reduced necrosis, while the higher temperatures favoured necrosis and 'shot-hole' at the cost of sporulation. Atmospheric water was the chief agent of spread of the conidial inoculum. Secondary infection commonly occurred in successive waves due to specific infection periods. The critical period for development and control began when the secondary inoculum became available and continued until the leaves had ceased functioning.

In spraying and dusting tests the best control was given by Bordeaux mixture (3–4–50) and lime-sulphur (1 in 40) applied (1) just after petal-fall, (2) about two weeks later, and (3) just after harvest, with an additional application about two weeks after the second one in the

case of the lime-sulphur. The Bordeaux mixture gave better results than the lime-sulphur, both as regards disease control and improvement in the crop and condition of the trees. Improved orchard sanitation, beginning before infection started, was an effective supplementary control measure.

SUKHORUKOFF (K. T.) & NATALJINA (Mme O. B.). **On the harmfulness of anthracnose of Black Currant.**—*C.R. Acad. Sci. U.R.S.S.*, xvii, 1–2, pp. 73–76, 1937.

Observations on anthracnose (*Pseudopeziza ribis*) of black currant [*R.A.M.*, xv, p. 448], made by the authors in the field on four-year-old plants, by means of monthly analyses of two-year-old branches, showed that infection is followed by a drop of 30 to 32·6 per cent. in carbohydrates and of 28·5 to 33·4 per cent. in lipoids in the perennial parts of the plant in the autumn-winter period. The shortage of these main nutrient reserves in the diseased plant unfavourably influenced growth and lowered the yield by up to 52·8 per cent. Although the effect of anthracnose on the resistance of the black currant to frost has not yet been determined, there is reason to suppose that it lowers the winter hardiness of the plant.

GANTE (T.). **Zur Resistenzzüchtung gegen Pseudopeziza ribis Klebahn. I. Beitrag zur Kenntnis der Infektionsbedingungen und der Kultur des Pilzes.** [On breeding for resistance to *Pseudopeziza ribis* Klebahn. I. A contribution to the knowledge of the conditions governing infection and the culture of the fungus.]—*Gartenbauwiss.*, xi, 5, pp. 675–696, 7 figs., 1937.

The writer's inoculation experiments with *Pseudopeziza ribis* on gooseberries and currants [*R.A.M.*, xiii, p. 173; xvi, p. 756, and preceding abstract] carried out principally in the field at the Kaiser Wilhelm Plant Breeding Institute, Müncheberg, Mark Brandenburg, involved the use of Rudloff and Schmidt's method (*Gartenbauwiss.*, ix, p. 65; *Züchter*, vi, p. 288, 1934), whereby the test material is enclosed in cellophane bags lined with damp blotting paper with provision for the absorption of water from Erlenmeyer flasks. The period of exposure to these excessively humid conditions averaged four days. The temperature during the trials approximated to the optimum for *P. ribis*. Conidial suspensions of the fungus from pure cultures on yeast water plus 1 per cent. cane sugar were applied to the leaf surfaces by means of a paintbrush or atomizer. Infection took place chiefly through the under side. Leaves of all ages contracted anthracnose under the experimental conditions herein described, whereas in nature the older foliage is first attacked. Not only were the susceptible Large Red Cherry and Dutch White currants successfully inoculated in these tests, but also the normally resistant Dutch Red, Gondouin Red, and Erstling aus Vierlanden currants and the American Carrie and Houghton gooseberries. Spontaneous infection of such semi-resistant varieties may also occur late in the season; their utility for breeding purposes, however, is not impaired thereby, since such attacks virtually coincide with the normal period of defoliation.

Brief notes are given on two other diseases affecting currants and

gooseberries in Germany, viz., leaf spot (*Mycosphaerella ribis*) [*M. grossulariae*: *R.A.M.*, xiv, p. 774] and rust (*Cronartium ribicola*) [ibid., xvii, p. 281].

CHEESMAN (E. E.) & WARDLAW (C. W.). **Specific and varietal susceptibility of Bananas to Cercospora leaf spot.**—*Trop. Agriculture, Trin.*, xiv, 12, pp. 335–336, 1937.

The authors state that recent surveys have indicated that high resistance to *Cercospora musae* leaf spot [*R.A.M.*, xvii, p. 191] is the rule among the important collection of wild banana species at the Imperial College of Tropical Agriculture in Trinidad, and that most of the hybrids bred from them at the College are quite free from leaf spotting. Of particular interest for the eventual development of a good export banana, resistant to the leaf spot, is the I.C. 2 hybrid, derived from the Gros Michel as the female and the wild seeded *Musa acuminata* as the male parent, which field observations in various parts of the island have shown to be very mildly susceptible, spotting occurring only on the oldest leaf; in leaves sent in for examination as being badly infected, the spotting was found to have been caused not by *C. musae* but by *Cordana* [*Scolecotrichum*] *musae* [loc. cit.], a weak parasite on senile leaves. Of the collection of cultivated banana types at the College, eight were found to be highly resistant to, or immune from, both *C. musae* and Panama disease [*Fusarium oxysporum cubense*]; they are, however, probably useless as parents of new varieties since they are not possessed of desirable commercial properties.

FERNANDO (M.). **A note on a soft rot of stored Mangoes caused by Botryodiplodia theobromae Pat.**—*Trop. Agriculturist*, lxxxix, 6, pp. 381–387, 1 pl., 1 graph, 1937.

A brief account is given of the author's investigation of a soft rot which developed in 1937 in stored Chembattan mangoes at the Farm School, Jaffna, and Peradeniya, the causal organism of which was found to be *Botryodiplodia theobromae* [cf. *R.A.M.*, xvi, p. 670]. Although this is stated to be the first record of the fungus causing a storage rot of mangoes in Ceylon, examination of decayed mangoes from the Municipal Market at Kandy showed that the disease is not as uncommon as at first thought, and two strains of *B. theobromae* were isolated from fruits of the Parrot and Papaw varieties. In 78 of the 97 Chembattan mangoes examined, infection had occurred through the stalk end. While the disease is essentially one of the ripe fruit, invasion of green fruits has also been occasionally observed. The strains from the Chembattan and the Parrot mangoes were experimentally demonstrated to be pathogenic to the fruits, and to secrete a vigorous protopectinase enzyme. Control measures for the trouble are briefly discussed.

LEWCOCK (H. K.). **Yellow spot disease of Pineapples.**—*Qd agric. J.*, xlviii, 6, pp. 665–672, 5 figs., 1937.

Pineapple yellow spot [*R.A.M.*, xvi, p. 114] was observed for the first time in Queensland in October, 1937, when an outbreak, confined to the tops of maturing fruit, occurred in a two-year-old planting in the Mary Valley. Most of the fruit had already been harvested, but

between 1 and 2 per cent. of the remainder were affected, mostly so severely as to be worthless. In Hawaii the disease affects young plants propagated from tops more commonly than it does the tops of maturing fruit, but no top plants of a susceptible age were found in the vicinity of the affected field.

Insufficient data are available to indicate the effect of local climatic conditions on seasonal incidence or the extent to which the disease may be expected to develop, but as spread in this first outbreak appeared to have been arrested some time before October, it appears probable that, as in Hawaii, the development of the disease will be considerably retarded during prolonged dry periods.

RUMP (L.). **Beitrag zur Frage der Dosierung von Trockenbeizmitteln für kleinste Mengen feiner Sämereien.** [A contribution to the problem of the dosage of dusts for small quantities of fine seed.]—*Z. PflKrankh.*, xlvii, 12, pp. 596–603, 1 fig., 1937.

In order to determine the requisite quantity of a fungicidal dust, e.g., ceresan UT 1875 *a*, for the treatment of small quantities of fine seeds, such as those of flowers and vegetables, the writer has devised the following procedure. A sample of seed weighing 5 gm. is shaken up with the dust in a short-necked, globular extraction flask of 25, 50, or 100 c.c. capacity for a minimum period of five minutes or until the maximum possible adhesion of the dust to the seed is obtained. The non-adhering residue of the dust is removed with a fine-meshed sieve and the seed weighed with the adhering dust. The difference between the original weight of the seed and that after treatment indicates the amount of dust adhering and this dose is designated 1/1. In the tests herein described 0·267 gm. ceresan adhered to 5 gm. white cabbage seed. Directions are given for the estimation of the half dose and smaller fractions by mathematical formulae. Details are furnished of laboratory experiments on the germination of seed treated with various quantities of ceresan calculated by the above-described method, the uniformity and exactitude of which are amply demonstrated.

SCHNICKER (J. L.). **Kemikaliekontrollen i 1937.** [Inspection of chemical substances in 1937.]—*Tidsskr. Planteavl*, xlii, 4, pp. 620–630, 1937.

Notes are given on the various offences against the Danish plant protective and poison laws detected in the course of the official inspection in 1937 of some 400 samples of fruit tree carbolineum, nicotine preparations, mercury-containing fungicides, lead arsenate, Bordeaux paste, and lime-sulphur [*R.A.M.*, xiv, p. 379]. Analyses are furnished of the contents of a number of fungicides (including some well-known preparations of international repute) and insecticides officially authorized by the Danish Plant Protection Service.

RECKENDORFER (P.). **Die chemischen Grundlagen der Wirkungsweise der Schwefelkalkbrühe.** [The chemical bases of the mode of action of lime-sulphur mixture.]—*Phytopath. Z.*, x, 3, pp. 306–331, 1937.

In this study on the fungicidal action of lime-sulphur [cf. *R.A.M.*, xv, p. 240] the author investigated the oxidation products obtained on passing purified atmospheric oxygen through the fungicide (10 c.c.

diluted with 200 c.c. distilled water). No visible sign of decomposition was evident until after 45 minutes, the decomposition taking place very slowly without any evidence of the formation of hydrogen sulphide. Whereas 100 c.c. of the original mixture contained 1·86 gm. thiosulphate sulphur, 11·87 gm. polysulphide sulphur, and 3·18 gm. monosulphide sulphur, after three hours' oxidation the values were 6·40, 1·92, and 0·36 gm., respectively. On the basis of these results the author deduces that the volume of oxygen required to oxidize 6 c.c. of the original mixture would be 3,000 c.c., which was passed through the apparatus in $\frac{1}{3}$ minute, so that lime-sulphur must be regarded as highly resistant to the action of oxygen. Until the polysulphides are extremely desiccated the mixture will resist oxidation and decomposition, but in the open, as the spray film dries, oxidation takes place with great rapidity and intensity. The analytical figures show that as the poly- and monosulphide sulphur decreases the thiosulphate sulphur increases and it is apparent that the polysulphide state (estimated as the quotient of polysulphide sulphur/monosulphide sulphur) increases from 3·73 to 5·33 after three hours, the molecular weight increasing from 4·73 to 6·33 during the same period. On the basis of the analytical data it is necessary to assume the existence of a polysulphide in the original mixture higher than $Ca(S)S_4$. According to equations given in full: (*a*) the decrease of polysulphide is greater than the increase of thiosulphate sulphur; (*b*) the decrease of monosulphide sulphur must be greater than half the increase of the thiosulphate sulphur; (*c*) the oxidation of polysulphide and monosulphide sulphur runs largely parallel, showing that the total decrease of both these compounds, which must be present in a minimum ratio of 3 : 2·5, must exceed the increase of thiosulphate sulphur. The author thinks he is justified in assuming that, in respect of the polysulphide content of lime-sulphur mixture, the molecular degree CaS_5 is not the highest possible total stage, and that a polysulphide with a larger series value than 4 can be confidently postulated.

In a further experiment involving the passage of air instead of oxygen, the results were similar but hydrogen sulphide was abundantly formed. The mixture became turbid owing to the colloidal character of the sulphur and the influence of carbon dioxide. The passage of pure oxygen and pure carbon dioxide combined resulted in only traces of hydrogen sulphide, while pure carbon dioxide alone caused such an immense output of hydrogen sulphide as to preclude an exact statistical evaluation of the decomposition data.

[An abridged account of these experiments appears in *Wein u. Rebe*, xix, pp. 111–119, 1937.]

HORSFALL (J. G.), MARSH (R. W.), & MARTIN (H.). **Studies upon the copper fungicides. IV. The fungicidal value of the copper oxides.**— *Ann. appl. Biol.*, xxiv, 4, pp. 867–882, 1 pl., 1 graph, 1937.

In this further instalment of this series [*R.A.M.*, xvii, p. 260] the authors give an account of studies on the relative merits of cuprous and cupric oxides as fungicides, based on the conception that the field performance of a protective fungicide is dependent on (1) factors determining the quantity (retention and tenacity) [ibid., xvi, p. 695]

of material present throughout the period of protection, and (2) factors which determine the relative fungicidal value of the residue; this value is the resultant of availability [loc. cit.], inherent toxicity (determined by the chemical nature of the agent responsible for fungicidal value), and the particular fungus and/or host plant concerned. The fungicidal values of various samples of cuprous and cupric oxides, as judged by their inhibitory effect on the germination of the spores of *Macrosporium* [*Thyrospora*] *sarcinaeforme* and *Cladosporium carpophilum*, were determined in the laboratory, using a standardized method [which is briefly described] of spraying suspensions of the materials on to glass slides, which were then dried in a desiccator; the spore suspensions, adjusted as nearly as possible to 20 per low power field, were placed on the dried slides, incubated at 27° C. overnight, and examined the following morning. The results indicated that within each series of cuprous or cupric oxides, the fungicidal value is dependent on the method of manufacture and the particle size, and that, allowance being made for these two factors, cuprous oxide inhibited spore germination to a greater degree than cupric oxide of equivalent copper content. If the inhibitive action of these oxides is due to the formation of soluble copper derivatives, the greater fungicidal value of the cuprous over the cupric oxides may be explained both by the readier solubility of cuprous oxide in certain solvents (greater availability) and the greater potency of the active fungicide produced from cuprous oxide (greater inherent toxicity).

SCHNEIDERHAN (F. J.). **Preparation and properties of Bordeaux mixture.**—*Bull. W. Va agric. Exp. Sta.* 283, 30 pp., 11 figs., 1937. [Abs. in *Exp. Sta. Rec.*, lxxviii, 1, pp. 57–58, 1938.]

The data obtained from tests conducted with Bordeaux mixtures made from 43 different formulae indicated that instant Bordeaux mixture prepared from pulverized copper sulphate and high hydrated lime gives higher average suspensions than mixtures from stock solutions of copper sulphate and quicklime or from low hydrated lime. With both forms of lime from the same limestone the chemical hydrated form was of comparable activity to quicklime, as judged by its dispersion. In Bordeaux mixture (4–4–50) freshly prepared milk of lime gave a rather higher suspension than 15-days-old milk of lime.

Spherulites [spherical crystalline bodies], formed during the decomposition of the mixture, appeared in the 4–4–50 Bordeaux mixture after 75 hours at 23° to 25° C. The addition of 1·5 per cent. bentonite delayed their formation 28·5 hours, and when 0·5 per cent. of sugar or tannic acid was present as well they did not form in 15 days.

Colour-chart determination of 23 formulae indicated that no two are identical in colour; the highest suspension was correlated with the deepest blue shades, while mixtures of low copper sulphate concentration and high suspension were lighter than those of higher concentration and high suspension. The addition of lead arsenate at the rate of 3 lb., and of magnesium and calcium arsenate at that of 2·5 lb., per 100 galls. made no significant change in the suspension of the 4–4–50 mixture; the addition of bentonite, tannic acid, or sugar assisted suspension of this mixture after three hours.

Entoma: a directory of insect pest control.—142 pp., Eastern Br. Amer. Ass. econ. Ent., 1937.

This manual comprises, *inter alia*, information on some fundamental facts relating to the composition, preparation, and selection of insecticides for various purposes, lists of insecticides, fungicides, the ingredients used in their manufacture, and disinfectant machinery and supplies, together with the names and addresses of their makers.

AFANASIEV (M. M.). **Method of isolating single hyphal tips of Actinomyces.**—*Phytopathology*, xxvii, 12, pp. 1182–1183, 1937.

The author describes in detail a method of isolating single hyphal tips of *Actinomyces* by touching the tip of a young aerial hypha with the point of a glass needle dipped in sucrose solution and attached to the substage of a microscope, and transferring the needle point, after microscopic examination, to sterile albumin agar in a Petri dish.

SCHWEIZER (G.). **Einführung in die Kaltsterilisationsmethode.** [An introduction to methods of cold-sterilization.]—vi+80 pp., Jena, G. Fischer, [? 1937]. Price Rm. 5. [Abs. in *Zbl. Bakt.*, Abt. 2, xcvii, 9–13, p. 245, 1937.]

In many cases it is of the utmost importance both from the bacteriological and the mycological point of view to be able to use organic nutrient culture media which have been sterilized otherwise than by heat. The methods described in this manual consist mainly in the use of small quantities of volatile disinfectants and the intensification of their narcotic effects by negative pressure and simultaneous withdrawal of oxygen. One chapter is devoted to the description of a cold-sterilization apparatus, and there is a tabulated list of recommended disinfectants, their properties, and the uses for which they are particularly suitable.

Kultūraugu kaitēkļu, slimību un nezāļu apkaŗošana. [The control of insect, fungus, and weed pests of cultivated plants.]—207 pp., 88 figs., 2 diags., Latvian Plant Prot. Inst., 1937.

Notes are given on the symptoms and control of a large number of well-known pests and diseases affecting cultivated plants in Latvia.

BAUDYŠ (E.). **Draslo jako prostředek k ochraně rostlin.** [Potassium as a plant protective.]—6th ed., 96 pp., 33 figs., Prague, 1937.

In this pamphlet the author gives a richly documented survey of research work on the importance of potassium for the health of plants. Special mention is made of experiments in Czechoslovakia, the results of which indicated that spraying potatoes with a 2 per cent. potassium salt solution (especially kainit) affords good control of leaf roll and late blight (*Phytophthora infestans*). Excellent control of vine mildew (*Plasmopara viticola*) was also reported from three localities by spraying the vines, which had previously severely suffered from the disease, with a 10 per cent. kainit solution. Many more examples are also cited of the controlling effect of potassium applications on a wide range of plant diseases and insect parasites, a full list of which is appended at the end of the volume.

Journées de la lutte chimique contre les ennemis des cultures. Paris 19–25 mai 1937. [Papers on the chemical control of crop pests and diseases. Paris, 19–25 May, 1937.]—*Chim. et Industr.*, xxxviii, 4 bis, 255+xiv pp., 39 figs., 1 graph, 1937.

This valuable compilation of papers on the chemical aspects of the control of plant pests and diseases read at a series of meetings held in Paris in May, 1937, and organized by the Société de Chimie Industrielle with the collaboration of the Société de Pathologie Végétale et d'Entomologie Agricole de France includes, among many others, papers on cupric dusts (by Vinas), copper oxychlorides (Desrue and Lucain), casein Bordeaux mixture (Masselin), sulphur and its derivatives (Duprez), black sulphur (Granjon), natural sulphur (Lugan), colloidal sulphur (Lahaze), wettable sulphur and sulphide (Duprez), sulphur derivatives (Duprez), potassium permanganate (Schuppon), formalin (Chaux), vine mildew (*Plasmopara viticola*: by Marsais), the powdery mildews [which are listed] (Monchot), fungous diseases of peach and apricot (Joëssel), virus diseases of fruit trees (Dufrénoy and Bruneteau), and the chemical protection of timber against disease and decay (Lutz). Practically all the points dealt with have already been noticed in this *Review* from time to time.

Morstatt (H.). **Bibliographie der Pflanzenschutzliteratur: das Jahr 1936.** [A bibliography of plant protection literature for the year 1936.]—392 pp., Biol. Anst. (Reichsanst.) Berl., 1937.

This bibliography of German and foreign literature published during 1936 on various aspects of plant protection has been prepared on the usual lines [*R.A.M.*, xvi, p. 266].

Best (R. J.). **The chemistry of some plant viruses.**—*J. Aust. chem. Inst.*, iv, 10, pp. 375–392, 1 fig., 2 graphs, 1937.

In this paper, read at the conference of the Australian Chemical Institute held at Adelaide in May, 1937, the author discusses, with references to the relevant literature, some chemical aspects of plant and animal viruses, including tomato spotted wilt and tobacco mosaic. He concludes that there is no sharp break between living and non-living matter, and that viruses may be regarded as living molecules, of graded complexity of structure and organization, bridging the gap between the architecture of the larger non-living chemical molecules and that of the simplest living cell.

Smith (K. M.). **Some aspects of the plant virus problem.**—*Publ. Smithson. Instn* 3431, pp. 345–352, 2 pl., 1 fig., 1937. [Reprinted from *Rep. Smithson. Instn, 1936*, 2 pl., pp. 345–352, ? 1937.]

This is a reprint of a paper already noticed from another source [*R.A.M.*, xv, p. 455].

Ulbrich (E.). **Ergebnisse neuerer Forschungen über die Mykorrhiza.** [Results of recent studies on mycorrhiza.]—*S. B. Ges. naturf. Fr. Berl., 1936*, 4–7, pp. 253–274, 1937.

This is a review of some recent outstanding researches on the nature and distribution of tree mycorrhiza, with special reference to the

numerous familiar edible and poisonous fungi pursuing this symbiotic mode of existence in German forests.

Hiroe (I.). **Experimental studies on the saltation in fungi parasitic on plants.**—Reprinted from *Mem. Tottori agric. Coll.*, v, 1, 272 pp., 25 pl., 8 figs., 2 diags., 1937. [Japanese, with English summary.]

This is a comprehensive, fully tabulated account of the writer's studies, covering a period of ten years, at the Tottori (Japan) Agricultural College, on the phenomenon of saltation in plant-parasitic fungi, with special reference to *Helminthosporium* and *Brachysporium* [*R.A.M.*, xv, p. 511]. Two types of sectorial saltation are recognized: A, in which the sectors appear white among the blackish parent mycelial colony; and B, characterized by the development of dark sectors on pale colonies and vice versa. Type A, represented by *B. tomato*, the agent of tomato leaf blight, was found to be of very rare occurrence and was unaffected by any artificial treatments. The saltants, though losing their colour completely, do not differ from their parents in morphological and cultural characters. Reversion to the parental forms has never been observed. In type B, exemplified by *Alternaria kikuchiana*, the causal organism of black spot of Japanese pear [ibid., xiii, p. 775] and *Ophiobolus miyabeanus*, isolated from rice [ibid, xvi, p. 632], saltation is relatively profuse and is influenced by artificial treatments. The saltants are not so uniformly constant as in type A, gradual or sudden reversion to the parent form being sometimes observed. Deviation from the parents is expressed not only in colour but also in morphological characters.

The island type of saltation resembles sector type B in the instability of the saltants, the marked response to artificial treatments, and the morphological divergences from the parent form, to which are added various physiological peculiarities. Representatives of the island type include *O. miyabeanus*, *B. ovoideum* on Italian millet [*Setaria italica*], *B. tomato*, *Helminthosporium oryzae-microsporum* n.sp. (*Trans. Tottori Soc. agric. Sci.*, v, p. 175, 1935) and *B. senegalense* [*R.A.M.*, xv, p. 511] on rice, and *B. capsici* on chilli [ibid., xiv, p. 344]. In the case of *O. miyabeanus* the development of island saltants on potato juice agar appears to be an extension of 'pseudomyceliosis' [ibid., xii, p. 584], which in turn is correlated with an intensification of oxidase activity in profusely saltating cultures.

In conclusion, it is stated that whereas in the case of sexual reproduction hybridization and segregation are the main causes of permanent variations in fungi, mutation or saltation is chiefly responsible for their origin in fungi which reproduce themselves vegetatively.

Weindling (R.). **Isolation of toxic substances from the culture filtrates of Trichoderma and Gliocladium.**—*Phytopathology*, xxvii, 12, pp. 1175–1177, 1937.

As pointed out by M. Timonin and confirmed by C. Thom, the fungus yielding a crystalline toxic substance in recent experiments with the culture filtrate is not a *Trichoderma* but a *Gliocladium* [*R.A.M.*, xvi, p. 268]. The most noticeable difference between the toxic effects of the culture filtrates of the two organisms lies in the superior stability

at room temperature of the *Gliocladium* substance, both culture filtrates and aqueous solutions of the crystalline body derived therefrom remaining active for several days in an acid reaction. Both the original *Gliocladium* used in the studies from Californian soil, and other isolates of the fungus from *Gerbera* roots in New York State producing the crystalline toxic substance appear to belong to Thom's floccose-green series and agree fairly well with Gilman and Abbott's description of *G. fimbriatum* in their summary of soil fungi [ibid., vii, p. 57].

HANSEN (H. P.). **Studier over Kartoffelviroser i Danmark.** [Studies on Potato viruses in Denmark.]—*Tidsskr. Planteavl*, xlii, 4, pp. 641–681, 6 figs., 1 graph, 1937. [English summary.]

A detailed, fully tabulated account is given of the writer's studies on potato viruses in Denmark [*R.A.M.*, xvi, p. 705], the symptoms of the various disorders being described as they occur in some standard commercial varieties. Sydens Dronning [Southern Queen] is predominantly affected by an acute form of leaf drop streak. Virus E was found in a plant showing rugose mosaic symptoms, which were also induced on the same host by greenhouse inoculations with the virus. Aucuba mosaic and leaf roll were also observed in this variety, which may further serve as a carrier of X, though reacting to A by top necrosis [ibid., xvi, p. 53]. A form of rugose mosaic caused by virus Y was observed to be prevalent in Bintje, reducing the average yield by 60 per cent. in two years' tests. Ordinary (X) mosaic and leaf roll also affect this variety, and its yield was reduced by about one-third, due to extensive infection by giant hill. Bintje acts as a vector of virus E and sometimes also of X and A. Rugose mosaic (Y), leaf roll, and giant hill are the most common disturbances of King Edward, while Direktor Johanssen suffers from ordinary mosaic, a form of leaf drop streak caused by viruses X and Y [ibid., xvii, p. 265], and leaf roll, reacting to virus A by ordinary mosaic symptoms.

Antisera active against viruses Y, A, and X were prepared, the crude green juice generally being used as recommended by Chester [ibid., xvi, p. 767]. The precipitin in anti-X serum, derived from tobacco juice infected with a mild strain of X from an Up-to-Date potato plant, was completely absorbed by crude X virus juice but not by that from a healthy plant. The anti-X serum proved to be a reliable diagnostic reagent for virus X in the juice of tobacco, *Datura stramonium*, tomato, and potato; in the case of the last-named all the 69 plants tested reacted correctly, irrespective of variety, presence or absence of viruses Y, A, or E, and nature of the symptoms displayed. Top necrosis failed to induce any reaction with crude juice, whether the disease was caused by virus X (as in King Edward and Epicure) or A (Up-to-Date and Southern Queen). The anti-X precipitin succumbed to ten minutes' heating at 80° C. but not at 70°, the process of dissolution apparently coinciding with serum coagulation.

The reactions obtained with anti-Y serum in crude juices containing the Y virus were less clearly defined than those induced by anti-X, but an improvement in this respect was effected by the use of a constant temperature bath maintained at about 40° instead of room tempera-

ture. Both viruses Y and A reacted similarly with anti-Y precipitin, the potato varieties used in this test being Bintje (externally healthy and with rugose mosaic), King Edward (externally healthy), and Juli (crinkle). The precipitin was completely absorbed by potato juice containing either Y or A, but not by that of healthy plants. The two viruses, when occurring in combination in the potato, were further shown to maintain their individual characteristics unchanged, both as regards effect on the host and relation to juice inoculation. These two infective principles failed to confer reciprocal immunization on Up-to-Date and Juli potatoes [ibid., xvi, p. 704 *et passim*], thereby refuting Birkeland's theory that serological relationship and the capacity for a mutually protective action in the host are necessarily correlated [ibid., xv, p. 671].

The preparation of maps showing the distribution of the various potato virus diseases in Denmark is advocated together with further studies on varietal reaction and reduction in yield due to viruses. Particulars are given of the methods employed in the production of virus-free tubers at the writer's 30-hect. farm near Copenhagen.

Folsom (D.) & Bonde (R.). **Some properties of Potato rugose mosaic and its components.**—*J. agric. Res.*, lv, 10, pp. 765–783, 6 figs., 1937.

Rugose mosaic of potato [*R.A.M.*, xvi, p. 481] is ascribed by the authors to at least two viruses, the pure rugose mosaic or veinbanding virus and the latent mosaic virus. Inoculation experiments on several thousand plants in some hundreds of series were made by the authors in Maine. The leaf-mutilation method was chosen for inoculating potato plants, and a method involving painting the inoculum on the leaves by wooden pot stakes for inoculating tobacco and *Datura stramonium*. The usual source of inoculum was stock of the Green Mountain potato and inoculated tobacco plants. Tomato was less satisfactory than tobacco and *D. stramonium* for inoculation experiments, and bean [*Phaseolus vulgaris*] was apparently immune. Extract from foliage was found to be more infectious than that from colourless sprouts, seed-tubers, and roots, the infectivity of the rugose mosaic virus being apparently correlated with the amount of chlorophyll present. The inoculum from young diseased potato plants was more infectious than that from old, whereas the age of diseased tobacco plants was of little consequence. Dried leaves of both plants were entirely non-infectious. Ageing *in vitro* up to 4, 6, or 8 hours progressively increased the infectiousness of rugose mosaic inoculum, while further ageing reduced it; under certain conditions the inactivation was complete after a few days. The latent mosaic virus sometimes resisted ageing longer than the pure rugose mosaic virus.

The thermal death point of the pure rugose mosaic virus, as well as that of the composite virus, lies at a temperature of 60° or 65° C., although it varies with different plants. For the latent mosaic, which is more persistent, the temperature must be raised to 90°. Rugose mosaic extract became inactivated at about 1 to 0·1 per cent. upon dilution with water. Healthy potato juice had a somewhat greater effect than water. Latent mosaic was more persistent than rugose. Pokeweed (*Phytolacca decandra*) juice inactivated rugose mosaic but

not latent mosaic. Filtration considerably reduced the virulence of the rugose virus, but only slightly affected the latent virus. For rugose mosaic the point of inactivation by hydrochloric acid and by sodium hydrate varied with conditions; it lay at over 50 per cent. for ethyl alcohol, at about 5 per cent. for sodium chloride, at about 0·5 per cent. for formaldehyde, at about 0·2 per cent. for hydrochloric acid, and at about 0·1 per cent. for copper sulphate and sulphuric acid cleaning fluid. Latent mosaic responded similarly to most of these chemicals, but was more resistant to formaldehyde and sulphuric acid cleaning fluid. The virulence of latent mosaic was not increased by eight successive passages through tobacco plants.

Blümke. **Wie lässt sich der Kartoffelabbau bekämpfen?** [How can Potato degeneration be combated?]—*Mitt. Landw., Berl.*, lii, 49, pp. 1048–1050, 5 figs., 1937.

In connexion with a discussion of the possibilities of potato degeneration control in Germany [*R.A.M.*, xvi, p. 52], the writer emphasizes the importance of thorough roguing during May in order to forestall the transmission of infection from virus-diseased to healthy plants by leaf-sucking insects, of which probably the most important, at any rate in the central regions of the country, is the food bug (*Lygus pabulinus*). Under local conditions (Dessau) this insect does not appear in appreciable numbers before mid-June, the corresponding periods for the two other viruliferous groups (leafhoppers and aphids) being the beginning and end of July, respectively. Another very necessary measure is the complete isolation of selected stocks preferably by rows of maize or, if this is not available, merely by fallow ground.

Heinze (K.). **Zur Frage der Uebertragung der Kartoffelvirosen durch Jassiden.** [On the question of the transmission of Potato viruses by Jassids.]—*Phytopath. Z.*, x, 6, pp. 606–613, 4 figs., 1 graph, 1937.

Details are given of the writer's experiments at the Biological Institute, Dahlem, Berlin, in the transmission of infection from virus-infected to healthy potatoes by the widely prevalent Jassids, *Eupteryx atropunctata* and *Chlorita flavescens*. The insects were shown to be incapable of conveying the viruses from infected to sound plants, but they produced on certain varieties, e.g., Paul Krüger [President], injuries simulating those due to leaf roll, which were evidently mistaken by Elze (who reported the transmission of the disease by Jassids in Holland [*R.A.M.*, vii, p. 48]) for the genuine symptoms. A comparison of the plants suffering from pseudo leaf roll with those actually infected by the virus revealed fundamental differences, and moreover, the former condition was shown not to be transmissible to the progeny.

Friedrich (H.). **Studien über die Zusammenhänge zwischen der Lagerungstemperatur gesunder und kranker Kartoffelknollen und dem Redoxpotential ihrer Gewebebreie.** [Studies on the relationships between the storage temperature of healthy and diseased Potato tubers and the reduction-oxidation potential of their pulped tissues.]—*Phytopath. Z.*, x, 6, pp. 559–577, 1937.

The potentials measurable by means of the platinum electrode in

pulped potato tissue (Wartenberg and Hey's method) [*R.A.M.*, xvi, p. 705] do not depend exclusively on the extent of degeneration, varietal characters, and stage of dormancy of the tubers, but also on the temperature at which the material has been stored prior to testing. Reliable differential data can therefore be secured by this method only if both diseased and healthy stocks have been kept under uniform temperature conditions.

The influence of storage temperature was apparent in all the four varieties recently tested at the Biological Institute, Dahlem, Berlin, viz., Erstling [Duke of York], Jubel, Centifolia, and Direktor Johanssen, but considerable variations were observed in the response of the individual varieties to this factor. For instance, a Jubel selection was found after five weeks' warm storage (18° to 22° C). in the laboratory to have advanced on an average by 64 millivolts towards the negative pole in comparison with similar material kept in a cellar at 4° to 8°. Under comparable conditions the change registered in Centifolia was only 11 millivolts. To a lesser extent, different lots of the same variety may react differently to the influence of high or low temperatures, but no such differences could be detected between healthy and degenerate tubers.

Almost exactly the same differences of potential between healthy and diseased tubers were observed in two separate experimental series, in one of which a constant potential was maintained for over two hours and in another for over three.

COCKERHAM (G.). **Potato flowers and dissemination of Potato viruses.**—*Nature, Lond.*, cxl, 3556, pp. 1100–1101, 1937.

In referring to the suggestion included in K. M. Smith's recent text-book on plant virus diseases [*R.A.M.*, xvii, p. 52] that the potato virus X may be distributed in the field by a species of thrips feeding in the potato flowers, the author points out that of the 14 potato varieties which flower sparingly or not at all in Scotland ten have been shown by analyses of samples to contain the virus rather commonly, while the remaining four are invariably free from it in the field; the latter react by necrotic lesions when artificially inoculated with the virus by grafting, but the former do not. None of the freely flowering commercial varieties is free from the virus and none responds to inoculation with it by necrosis. The author considers that these observations would indicate that the absence of virus X in a variety is more closely related to the necrotic reaction than to the absence of flowers. The necrotic disease is rarely, if ever, seen in the field, since, necrosis being lethal, the perpetuation of diseased plants in the field is eliminated. The results of infection experiments suggest that entry of the virus into varieties to which it is lethal does not readily take place otherwise than through a graft union. Further observations are also quoted indicating that the position with regard to virus A is very similar to that of virus X, and evidence is adduced from a series of controlled field trials showing that removal of the flower buds from potato plants did not reduce the spread in them of non-necrotic viruses distributed by aphids.

STARR (G. H.). **Potato seed-treatment studies in Wyoming, 1932–36.**—*Bull. Wyo. agric. Exp. Sta.* 222, 52 pp., 5 figs., 1937. [Abs. in *Exp. Sta. Rec.*, lxxviii, 1, pp. 63–64, 1938.]

In tests conducted in Wyoming from 1932 to 1936, in which healthy seed pieces of Bliss Triumph and Cobbler potatoes and seed infected with *Rhizoctonia* [*Corticium solani*] and scab [*Actinomyces scabies*] were submitted to various chemical treatments [cf. *R.A.M.*, xvii, p. 200], no treatment significantly increased the yield of the healthy seed, but when the yields in all the tests were averaged it was found that mercuric chloride, acid mercury, semesan bel, mercurnol, and acid formaldehyde increased the yields, while hot formaldehyde and formaldehyde dust considerably decreased them. All the treatments gave about the same slight degree of scab control. Acid mercury was rather more effective against *C. solani* than mercuric chloride. Taking all the treatments on all the seed they ranked in the following declining order of merit for the production of disease-free tubers: mercuric chloride, acid formaldehyde, acid mercury, mercurnol, hot formaldehyde, semesan bel, and formaldehyde dust, all giving considerably better results than in the controls. Pre-sprinkling, carried out only in one year's tests, gave favourable results. The dusts tested were less effective than the liquid treatments.

The amount of scab that developed under different soil moisture conditions [loc. cit.] was, on the whole, greater in the non-irrigated plots, the reverse, however, obtaining in the fertilizer plots.

Soil infestation by both organisms ranged from slight to heavy. Applications of inoculated sulphur, ammonium sulphate, superphosphate, and other fertilizers to irrigated and non-irrigated soil did not in general control infection, but ammonium sulphate slightly reduced scab in non-irrigated plots.

BLATTNÝ (C.). **Pokus o vymezení oblasti ČSR. podle vhodnosti pro pěstění Bramborové sádě.** [An attempt to classify the districts on the territory of the Czechoslovakian Republic according to their suitability for the production of Potato seed material.]—*Ann. Acad. tchécosl. Agric.*, xii, 5, pp. 683–688, 1 map, 1937. [German summary.]

On the map of Czechoslovakia accompanying this paper the author has marked the districts which direct experiments, as well as meteorological, biological, and ecological observations during a period of years, have shown to be most suitable for the production of healthy (virus-free) potato seed tubers. Intermediate degrees of fitness down to complete unfitness for such production are also indicated. Localities are marked which may be used for the production of seed tubers of very early varieties on a small scale. The rest of the territory is considered to be suitable only for the commercial or private growing of potatoes for immediate consumption. The author believes that Czechoslovakia has every prospect of developing an important production of satisfactory potato seed tubers, sufficient at least to set the Republic free from the necessity of importing planting material.

Katsura (K.). **On the relation of atmospheric humidity to the infection of the Rice plant by Ophiobolus miyabeanus Ito et Kuribayashi and to the germination of its conidia.**—*Ann. phytopath. Soc. Japan*, vii, 2, pp. 105–124, 1937. [Japanese, with English summary.]

Rice seedlings inoculated with conidial suspensions of *Ophiobolus miyabeanus* [see above, p. 337] were kept in desiccators for 18 hours at a controlled temperature of 25° C. and varying relative humidities and then removed to a greenhouse bench. After five days typical symptoms of infection developed on the seedlings kept at 100, 97·5, 95, and 92 per cent. relative humidities for 18 hours, whereas those maintained at 89 per cent. for the same period remained quite healthy. Conidia of the fungus kept for 18 hours on slides in Petri dishes at 25° germinated at 92 but not at 89 per cent. relative humidity. From these data it would seem safe to assume that no infection of rice seedlings by *O. miyabeanus* takes place at a relative humidity below 89 per cent. and at 25° C.

Kalis (K. P.). **Tapproeven met twee sneden bij oculaties.** [Tapping experiments with two cuts on bud grafts.]—*Arch. Rubbercult. Ned.-Ind.*, xxi, 4, pp. 188–201, 1937. [English summary.]

The results [which are fully described and tabulated] of tapping experiments on *Hevea* rubber trees carried out on three plantations in Java for periods of 9 and 5 years and 16 months, respectively, showed no increase in the incidence of brown bast [*R.A.M.*, xvi, p. 557] in consequence of using two cuts instead of one, while the latex yield was augmented by 40 per cent. by the former method.

Heubel (G. A.). **Wondbehandeling bij Rubber.** [Wound treatment in Rubber.]—*Arch. Rubbercult. Ned.-Ind.*, xxi, 4, pp. 202–221, 10 figs., 1 diag., 1937.

Full directions are given for the treatment of wounds on *Hevea* rubber trees for the prevention of infection by *Botryodiplodia theobromae* [*R.A.M.*, xiii, p. 160] and *Ustulina zonata* [ibid., xvi, p. 798]. In a reclaimed area at the West Java Experiment Station *B. theobromae* caused the loss of 15 per cent. of the total number of bud grafts planted, while on another estate 30 per cent. were killed by the same pathogen, which enters the plant through the upper surface of the stump just above the grafting site. *B. theobromae* is particularly liable to infect bark scorched by exposure to intensely strong sunlight. *U. zonata* also penetrates bud grafts through stem stumps, causing complete decay of the wood below the wound and also of the tap-root in a case under observation. Small wounds should be covered with a thin layer of Product Socony 2295 A mixed with 3 to 5 per cent. pure carbolineum plantarium, while for larger ones the application of a mixture of asphalt 20/30 and 10 to 20 per cent. carbolineum plantarium is recommended.

Löhnis (Marie P.). **Plant development in the absence of boron.**—*Meded. LandbHoogesch. Wageningen*, xli, 3, 38 pp., 13 pl., 1937.

The results of the writer's experiments [which are fully described,

tabulated, and discussed in relation to contemporary investigations on boron deficiency in agricultural crops] denote that this element is essential for the growth of angiosperms, of which lucerne, dwarf and runner beans (*Phaseolus vulgaris*), and eight varieties of peas proved to be particularly sensitive to the lack of the accessory substance. Cereals appear to constitute an exception to the general rule, developing profusely in a culture medium without boron. Their boron content, however, is very low under natural conditions [*R.A.M.*, xvi, p. 582; cf. xvii, p. 89]. Calcium deficiency was found to induce much the same type of injury as a shortage of boron. The latter element may be supplied by tourmaline in the absence of any other source.

WATSON (MARION A.). **Further studies on the relationship between Hyoscyamus virus 3 and the aphid Myzus persicae (Sulz.) with special reference to the effects of fasting.**—*Proc. roy. Soc.*, Ser. B., cxxv, 838, pp. 144–170, 4 pl., 1938.

In further studies on the relationship between the virus Hy. III and the insect vector *Myzus persicae* [*R.A.M.*, xvi, p. 332], in which the insects were starved for different periods before and after feeding on the source of infection, it was found that the number of healthy tobacco plants infected was greatly increased when infection feeding, i.e. the feeding on infected plants, was immediately preceded by fasting; the efficiency of *M. persicae* as a vector of the virus increased rapidly during the first hour of fasting, but long fasting periods resulted in little increase in infectivity. The greater efficiency so induced decreased with protraction of the infection feeding period, and after one hour's feeding on the infected leaves aphids subjected to a preliminary fast gave no greater infection than others fed continuously.

After infection feeding had ceased the aphids lost their infectivity, the rate of loss being probably faster than the rate of deterioration of the virus *in vitro*. This loss of infectivity was complete in about one hour when the aphids were not given a preliminary fast before infection feeding, or when fed on an intermediate healthy plant between infection feeding and the infection trial; when the aphids fasted before and after the infection feeding loss of infectivity was slower.

Infectivity became increased after two or more equally long successive infection feedings, unless the insects were induced, as described above, to lose their infectivity between the feedings. The infectivity acquired at a second or third infection feeding was generally less than that acquired at earlier feedings, the difference being least after long fasting followed by very short feeding periods.

When the same preliminary fasting conditions operated during successive infection trials, some aphids consistently showed greater ability to transmit the virus than others, but when the preliminary fasting was varied, so that the aphids fasted and fed continuously, at alternate infection trials, no individuals showed any consistent superiority in transmission. This indicates that two factors connected with fasting govern infectivity, of which one, probably the less effective, is 'appetite'.

These results can be explained on the assumption that during transmission from plant to plant the virus comes into contact with some

inactivating substance, probably trypsin, the chief proteolytic enzyme found in the stomach of insects, in which enzyme production generally ceases during starvation. There is, at present, no evidence to show how the virus comes into contact with trypsin in the body of the insect, but a parallel can be drawn between the partial inactivating effect, *in vitro*, of small quantities of trypsin acting for long periods, and the prolonged infectivity of insects fasted immediately after a short infection feeding.

B[ELL] (A. F.). **Save P.O.J. 2878!**—*Qd agric. J.*, xlviii, 9, pp. 714–718, 4 figs., 1937.

Growers of sugar-cane in southern Queensland, especially in the Moreton area, are urged to take immediate steps to prevent any spread of Fiji disease [*R.A.M.*, xvii, p. 66], lest the cultivation of the susceptible but otherwise highly desirable P.O.J. 2878 cane should have to be abandoned. The cane contains one-eighth wild blood, which confers resistance to gumming [*Bacterium vasculorum*: loc. cit.] and mosaic, but at the same time renders it susceptible to Fiji disease. It is recommended that growers should plant only healthy cane from healthy farms, dig out diseased stools by November–December, cease to ratoon diseased crops, take extra care in areas where the growth conditions are very good, plant resistant varieties in fields adjacent to those where the disease has become established, and watch for the appearance of infection on neighbouring farms.

B[ELL] (A. F.). **Sooty mould on Sugar Cane in the Babinda district.**—*Qd agric. J.*, xlviii, 6, pp. 724–725, 1937.

During the past two years sugar-cane in the Babinda area of Queensland has been widely affected by sooty mould which, though generally confined to old leaves, is found on the young leaves of canes stunted by inadequate drainage, infertile or highly acid soils, and chlorotic streak [fourth disease: *R.A.M.*, xvi, p. 561]. The sooty mould causes still further stunting. The remedy thus lies in the prevention of the initial stunting.

HANSFORD (C. G.). **Annotated host list of Uganda parasitic fungi and plant diseases. Part IV.**—*E. Afr. agric. J.*, iii, 3, pp. 235–240, 1937.

This further instalment of the author's list of parasitic fungi and plant diseases so far recorded in Uganda is on the same lines as the preceding ones [*R.A.M.*, xvi, p. 838], and includes hosts belonging to 13 families.

Rhizoctonia [*Corticium*] *solani* and *R. bataticola* [*Macrophomina phaseoli*] cause damping-off of *Coffea arabica* nursery seedlings. The disease, which may spread rapidly through the affected beds, is favoured by overcrowding and damp conditions; in the absence of these factors, it may be avoided. *R. lamellifera* is common on dead and dying coffee roots, especially on the fine branches. *Fusarium sporotrichioides* was isolated from the stamens of coffee flowers that refused to open normally and remained sterile. Inoculation tests gave negative results.

Irenina glabra forms small black patches on the leaves, stems, and berries of *C. robusta*; though parasitic on the epidermis the fungus does no

appreciable harm. *Hemileia vastatrix* is unimportant on *C. robusta*, and the site of the original rust infection is sometimes surrounded by dark brown spots due to penetration of the leaf tissue by *Cephalosporium* sp.

Other records include sunflower (*Helianthus annuus*) leaf spot (*Cercospora pachypus* Ell. & Kell.); *Colletotrichum nigrum*, *Vermicularia capsici* [ibid., xi, p. 545], and *Gloeosporium piperatum* on chillies (*Capsicum annuum*), attacking the fruit, through which they tend to invade the stems, causing considerable die-back in severe cases, which are, however, rather rare; and downy mildew (*Peronospora lamii*) of sweet basil (*Ocimum basilicum*), which caused such mortality at Kampala that the cultivation of the host (for the extraction of essential oil) was abandoned.

NATTRASS (R. M.). **A first list of Cyprus fungi.**—xvi+87 pp., 15 pl., 1 graph, 2 maps (1 col.), Nicosia, Cyprus Department of Agriculture, 1937.

This list of 351 fungi collected in Cyprus from 1931 to 1937 is preceded by a brief account of the geographical configuration, climate, and natural and cultivated vegetation of the island. The new species proposed (with Latin diagnoses) are *Alternaria cichorii* on living leaves of chicory, *Hendersonula cypria* on a branch of apricot, *Phaeodothis hyparrheniae* on leaves of *Hyparrhenia hirta* Stapf., *Phyllachora ravennae* on leaves and sheaths of *Erianthus ravennae*, *Sporocybe cypria* on the bark of *Populus nigra*, and *Uromyces aeluropodis-repentis* on leaves, sheaths, and culms of *Aeluropus repens* Parl. and *A. littoralis* (Gm.) Parl. *Uromyces vesicatorius* (Bubák) and *Microdiplodia warburgiana* (Reichert) are proposed as new combinations, the synonym of the latter being *Diplodia warburgiana* Reichert.

A. cichorii n.sp. is identical with an undescribed species of *Alternaria* recorded on chicory in Florida by Weber. It resembles *A. crassa* (Sacc.) Rands [*R.A.M.*, xiii, p. 597], but differs in having frequently branched beaks and being non-pathogenic to *Datura* sp. It differs from *A. solani* (Ell. & Mart.) Jones & Grout in the somewhat smaller size of the conidia, in having longer and more slender beaks, and in being non-chromogenic in culture. It is non-pathogenic to both potato and lettuce, while neither *A. crassa* nor *A. solani* appears to be able to infect chicory. The conidiophores measure 25 to 28 by 6 to 12 μ, and the elongate, oval or fusoid, obclavate conidia, measuring 60 to 130 by 14 to 20 μ, are provided at the apex with a filiform beak, up to 280 by 2 to 3 μ, which is frequently branched.

Attention is drawn to the fact that *Synchytrium endobioticum* and a number of other important parasitic fungi have not yet been recorded in Cyprus.

CASTELLANI (E.) & CIFERRI (R.). **Prodromus mycoflorae Africae orientalis italicae.** [A first instalment of the mycoflora of Italian East Africa.]—153 pp., Florence, Ist. agric. colon. ital., 1937.

This is an annotated list, preceded by a ten-page bibliography, of the fungi so far recorded from Italian East Africa [*R.A.M.*, xvi, p. 279], which number 683 species distributed among 256 genera. Thirty-one of the species on eight hosts included in the compilation were observed

by the writers for the first time, while a further five species were detected on new hosts. Six new combinations are made, four of which involve the transference of species of *Trabutia* on *Ficus* spp. to *Phyllachora*. Fungus and host indexes are appended.

FISCHER (E.). **Ueber einige von E. Gäumann in Java und Celebes gesammelte Ustilagineen und Uredineen.** [On some Ustilagineae and Uredineae collected by E. Gäumann in Java and Celebes.]—*Ber. schweiz. bot. Ges.*, xlvii, pp. 419–424, 1937.

This is a critically annotated list of two Ustilagineae and twelve Uredineae collected by E. Gäumann in Java and Celebes from 1919 to 1922, including *Sorosporium reilianum* on sorghum [*R.A.M.*, xvi, p. 598], *Aecidium mori* on mulberry (*Morus indica*) [ibid., xii, p. 396] (both in Celebes), and three new species, two of *Aecidium* and one of *Uredo*, with Latin diagnoses.

COKER (W. C.), MATTHEWS (VELMA D.), & BARNHART (J. H.). **Blastocladiales, Monoblepharidales: Blastocladiaceae, Monoblepharidaceae. Saprolegniales: Saprolegniaceae, Ectrogellaceae, Leptomitaceae. Bibliography.**—*N. Amer. Flora*, ii, 1, pp. 1–76, 1937.

This is a comprehensive, critically annotated list of 13 species belonging to four genera of the Blastocladiaceae and of seven in the one genus (*Monoblepharis*) of the Monoblepharidaceae (by W. C. Coker); 80 species comprised in 15 genera of the Saprolegniaceae, three in two of the Ectrogellaceae, and 11 in five of the Leptomitaceae (by W. C. Coker and Velma D. Matthews), all occurring in the U.S.A. A seven-page bibliography, compiled by W. C. Coker and J. H. Barnhart, is appended.

LAVROV [LAVROFF] (N. N.). **Tilletiaceae novae vel rarae Unionis Soveticae.** [New or rare Tilletiaceae in the Soviet Union.]—*Animad. syst. Herb. Univ. tomsk.*, xi, 1, pp. 1–4, 1937.

This is an annotated list of 16 species of smuts collected by the author on the territory of the U.S.S.R., eleven of which are described as new to science [with Latin diagnoses], and two as new varieties. The following two fungi may be mentioned as occurring on hosts of economic significance, namely: *Entyloma korshinskyi* n.sp. on living leaves of *Hordeum distichum* var. *nutans* from Asia Minor, and *E. camusianum* P. Har. var. *pratense* n.var. on *Phleum pratense* from West Siberia.

HIRATSUKA (N.). **Miscellaneous notes on the East-Asiatic Uredinales with special reference to the Japanese species, I, II, III.**—*J. Jap. Bot.*, xiii, 4, pp. 244–251; 8, pp. 587–594, 1937; xiv, 1, pp. 33–38, 1938.

The following are among the records contained in this critically annotated list of eastern Asiatic (mainly Japanese) Uredinales [cf. *R.A.M.*, xvi, pp. 63, 411], [the new species of which are furnished with Latin diagnoses]. *Chrysomyxa tsugae* n.sp. produces on the twigs of *Tsuga sieboldii* in Honshû, Japan, orange to reddish-brown teleutosori, 1 to 9 mm. in length, 0·4 to 0·9 mm. in width, and up to 0·6 mm. in height, and forms chains, 150 to 290 μ long, of oblong to square,

smooth, hyaline teleutospores, 18 to 42 by 8 to 14 μ. *Pileolaria pistaciae* Tai & Wei (*Sinensia*, iv, p. 108, 1933) occurs on *Pistacia chinensis* in Formosa—a new addition to the Japanese mycoflora. *Chrysanthemum frutescens* is a new host for *Puccinia heeringiana* Kleb. *Melampsora arctica* is found on *Salix aquilonia*, *S. subreniformis*, and *S. yezoalpina*, its alternate host being *Saxifraga exilis* [*R.A.M.*, xvi, p. 492]. *Picea excelsa* and *P. jezoensis* are infected by *Barclayella deformans* (*Chrysomyxa abietis*) [ibid., xvi, p. 357]. *Pucciniosira clemensiae* Arth. & Cumm., a new record for Japan, occurs on *Berberis kawakamii*, a new host for the fungus. *Aecidium niitakense* n.sp. on *B. morrisonensis* is characterized by small groups of epiphyllous subepidermal, reddish, later nearly black spermogonia, 100 to 150 μ in diameter; few (2 to 24) hypophyllous, shortly cylindrical aecidia, 200 to 280 μ in diameter with irregular, mostly subrhomboid peridial cells, 30 to 48 by 20 to 33 μ, furnished with a verrucose-striate outer wall, 6 to 10 μ in thickness, and a densely verrucose inner one, up to 6 μ in thickness; and globose, subglobose, or obovate, densely verrucose, subhyaline aecidiospores, 18 to 27 by 15 to 23 μ, with an epispore 1 to 1·5 μ in thickness.

Garrett (A. O.). **The Uredinales or rusts of Utah.**—*Bull. Utah Univ.*, xxviii, 7, (Biol. Ser., iv, 1), 81 pp., 8 pl., 1937.

This is an annotated list of 185 rusts collected in Utah during the last 34 years, preceded by a key to the 15 genera occurring in the State and followed by fungus and host indexes.

Rick (J.). **Polyporaceae riograndenses.** [Polyporaceae of the Rio Grande.]—*Broteria*, vi, 4, pp. 153–168, 1937.

Latin descriptions are given of 44 Polyporaceae from the Rio Grande Valley, Brazil, including two new species [*R.A.M.*, xiv, p. 333].

Rick (J.). **Poriae riograndenses.** [Poriae of the Rio Grande.]—*Broteria*, vi, 3, pp. 128–150, 1937.

Latin descriptions are given of 75 species of *Poria* from the Rio Grande Valley, Brazil, including eight new ones.

Servazzi (O.). **Su due nuove Pestalotia.** [On two new species of *Pestalotia*.]—*Boll. Lab. sper. R. Oss. Fitopat., Torino*, xiv, 1–4, pp. 32–39, 2 pl., 1937.

A morphological and cultural account [without Latin diagnoses] is given of two species of *Pestalozzia* considered to be new to science, viz. *P. paeoniae* isolated in 1936 from leaf spots on *Paeonia arborea*, and *P. photiniae* in 1937 from similar spots on *Photinia arbutifolia* in Turin.

Bitancourt (A. A.). **Novas especies de Sphaceloma sobre Terminalia e Genipa.** [New species of *Sphaceloma* on *Terminalia* and *Genipa*.]—*Arch. Inst. biol. Def. agric. anim., S. Paulo*, viii, 13, pp. 197–200, 2 pl., 1937.

Diagnoses are given in Latin and Portuguese of *Sphaceloma terminaliae* n.sp., producing numerous pulvinate to crateriform lesions, 0·5 to 6 mm. in diameter, ranging in colour from dark livid, warm

blackish- or clove-brown to vinaceous pinkish-buff according to site, on the leaves and fruits of *Terminalia catappa*; and of *S. genipae* n.sp., forming dry, circular or elongated, carrot-red, pecan-brown, vinaceous-buff, or Natal brown spots on the foliage of *Genipa americana*, causing rugosity and distortion. *S. terminaliae* is characterized by black, erumpent acervuli, 20 to 200 μ in diameter, and dark, coalescent conidiophores, 15 to 25 μ in height, bearing continuous or uniseptate, hyaline, ovate, or elongated conidia, 10 to 15 by 4 to 6 μ. The white or grey, circular or elongated, erumpent acervuli of *S. genipae* measure 20 to 200 by 10 to 20 μ, and the oblong, pale yellow conidiophores, 10 to 20 μ in width, bear continuous, hyaline, globose, or oval conidia, 3 to 6 by 3 μ, and similar microconidia, 0·5 to 2 μ in diameter.

Couch (J. N.). **A new fungus intermediate between the rusts and Septobasidium.**—*Mycologia*, xxix, 6, pp. 665–673, 1 pl., 27 figs., 1937.

An account is given of a fungus found in South Carolina overgrowing dead scale insects (*Aspidiotus* sp.) on the bark of several deciduous trees in association with *Septobasidium* sp. The organism apparently combines to a remarkable degree some of the characters of the rusts and of *Septobasidium*, in that its spore forms strikingly resemble those of certain rusts, while in its parasitism on scale insects it resembles *Septobasidium*. A new genus, *Uredinella*, is erected for this fungus, which is named *U. coccidiophaga* n.sp., [with Latin diagnoses].

Dodge (B. O.). **The perithecial cavity formation in a Leptosphaeria on Opuntia.**—*Mycologia*, xxix, 6, pp. 707–716, 2 pl., 1937.

The author discusses at some length the formation of the cavities in the perithecia of a fungus which he found associated with *Hendersonia opuntiae* [*R.A.M.*, v, p. 303] on segments of *Opuntia lindheimeri* from Texas, collected by Wolf and deposited in the Herbarium of the New York Botanical Garden. A description is given of the organism, which is considered to be new to science and is named *Leptosphaeria opuntiae* [with diagnoses in English and Latin]. The perithecia measure 150 to 300 μ in diameter, the cylindrical, rather thick-walled asci 70 to 90 by 12 to 15 μ, and the olivaceous-brown, 3-septate ascospores 17 to 20 by 5 to 6·5 μ, the middle cells of the ascospores are larger than the end cells and are sometimes divided by a longitudinal wall. Numerous ascocarps of this fungus were also found in a specimen labelled '*H. opuntiae* E. & E.' from Alabama in the Ellis Herbarium.

Tobacco breeding bibliography.—19 pp., Imperial Bureau of Plant Genetics, School of Agriculture, Cambridge, 1937. [Mimeographed.]

In this bibliography of some 150 titles of papers (mostly recent), a number of the references, which are arranged in alphabetical order of authors, relate to diseases or abnormal conditions of the crop.

Kostoff (D.). **Cytogenetic aspects for producing Nicotiana tabacum forms localizing Tobacco mosaic virus.**—*Phytopath. Z.*, x, 6, pp. 578–593, 1937.

The problem of breeding tobacco varieties immune from mosaic for

the cigar and cigarette industry is greatly complicated by the absence of any immune (as distinct from resistant) forms within the species *Nicotiana tabacum*. The question thus arises whether the immunity from mosaic inherent in certain other *N.* spp. is transferable to *N. tabacum*, in connexion with which five points should be taken into account, namely, the immunity of the species, the ability to hybridize with *N. tabacum*, the extent of chromosome conjugation in *N. tabacum* species hybrids, the fertility of these species hybrids, their response to the mosaic virus, and the inheritance of this response.

Discussing the available information in respect of the reaction of *N.* spp. (numbering over 45) to the mosaic virus, the writer points out the importance of environmental conditions in the development of a particular type of response. *N. glauca* leaves, for instance, which readily contract mottling in the field at the Krasnodar (U.S.S.R.) Tobacco Institute, do not show this symptom in the greenhouse at Leningrad or Moscow. *N. sylvestris*, and, to a slighter degree, *N. longiflora*, *N. multivalvis*, *N. repandiformis*, and *N. tomentosiformis* react to infection by stunting and foliar mottling or even malformation. In most strains of *N. suaveolens* infection by the mosaic virus is not followed by mottling or distortion of the foliage, whereas in *N. sanderae* and *N. alata* some strains develop mottled leaves and others possess the capacity (probably conferred by intercrossing with *N. langsdorffii*, or possibly by mutation) of localizing the virus at the site of infection or forming necrotic systems [*R.A.M.*, xvi, p. 213].

The *N.* species which cross most readily with *N. tabacum* are *N. sylvestris*, *N. tomentosiformis*, *N. tomentosa*, and *N. glauca*. The hybrids of *N. tabacum* with other species are generally self-sterile, though in exceptional cases seeds are obtainable from the crosses *N. rustica*×*N. tabacum*, *N. sylvestris*×*N. tabacum*, and *N. tabacum*× *N. tomentosiformis* when flowering in the field. Little prospect of transferring the 'necrotic' response from the hybrid partner to *N. tabacum* is afforded by crossing the latter with species of incompatible chromosome relationships.

No mottling has been observed during the last ten years in mosaic-infected field and greenhouse plants of crosses between *N. glutinosa* or *N. suaveolens* and *N. tabacum*, the response of *N. rustica*×*N. tabacum*, *N. tabacum*×*N. alata*, and *N. tabacum*×*N. sanderae* hybrids being variable, while all others react by more or less severe foliar mottling and distortion. The F_1 hybrid reactions to mosaic infection may be thus expressed: mottling and distortion ensue when both parents react by these symptoms, while when one parent reacts by the formation of necrotic lesions this behaviour is commonly, but not invariably, followed by the hybrids. Amphidiploid hybrids react in the same way as the F_1 hybrids from which they originate, whereas composite hybrids, containing the whole genoms from the component species, respond differently. Thus, the hybrids (*N. tabacum*×*N. glauca*)× amphidiploid (*rustica*×*tabacum*), having two whole *N. tabacum* genoms (mottling), one *N. rustica* genom (necrotic), and one *N. glauca* genom (mottling), formed mottled leaves on infection by the mosaic virus. The F_1 *rustica*×*tabacum* and *rustica*× *glauca* hybrids, having one genom from a mottled type (*tabacum*×*glauca*) and one

from a necrotic (*rustica*), reacted to infection by the development of necrotic lesions, whereas the crosses (*tabacum*×*glauca*) ×amphidiploid (*rustica*×*tabacum*) produce mottled leaves, since one necrotic genom (*rustica*) cannot predominate over three of the mottling type (two *tabacum* and one *glauca*).

Some further theoretical considerations on the cytogenetics of tobacco crossing are advanced and discussed in relation to the practical aspects of breeding for the commercial purposes indicated above.

HILL (A. V.). **Big bud of Tobacco.**—*J. Coun. sci. industr. Res. Aust.*, x, 4, pp. 309–312, 1937.

Tobacco in New South Wales, Victoria, Queensland, and South Australia has been observed to show symptoms closely resembling those of tomato 'big bud' or bunchy top [*R.A.M.*, xiii, p. 62; xv, p. 406]. In 1936–7 16 per cent. of the plants in some fields in northern New South Wales were affected, though the quality of the leaf in many cases was not greatly impaired. As a rule, under 3 per cent. of the plants in individual fields are attacked. That the disease is caused by the same virus as that producing tomato big bud was indicated by successful grafting of scions of affected tobacco plants in the field on to a healthy tomato plant in the greenhouse, and by reciprocal grafts, the previously healthy plants developing typical symptoms in each case.

Scattered infections appear in the field in January, the affected plants being distinguishable at a distance by their recurved leaves hanging down close to the stem, the many small leaves present on shoots from axillary buds, and the proliferation and virescence of the flowering parts; they may reach only 1½ or 2 ft. in height. If the disease develops before topping, the leaves are usually worthless. The condition persists in overwintered plants, and appears on the new growth in the spring.

In the greenhouse the first symptom is a clearing of the small veins of leaves produced shortly after inoculation. The leaves hanging down round the stem may be distorted and twisted, the tips curving under and upwards. They become thick, brittle, and yellowish-green, and the upper surface is glazed. The leaves formed after infection are progressively smaller. In older leaves, necrosis of the veins, generally starting from the tips and margins, but sometimes chiefly affecting the midrib, appears as a network of dark lines.

Axillary buds develop early, and produce short shoots (some only 1 or 2 cm. long) with many small leaves. In the field, axillary shoots do not generally reach the flowering stage.

Flowers already formed when the virus reaches the inflorescence may appear normal, but the anthers and pistils usually fail to develop, and viable seed is seldom produced. The inflorescence generally develops numerous short branches. The flowers developing after invasion of the inflorescence are partially or completely virescent. In the field, the flower parts are generally virescent, and may be modified into leaf-like structures 5 cm. or more long. The calyx is frequently enlarged and bladder-like, and the floral axis may extend and proliferate into short branches with small leaves. The excessive development of short branches and the proliferation and virescence of the flowers result in a compact, tufted habit of growth.

Stanley (W. M.). **A comparative study of some effects of several different viruses on Turkish Tobacco plants.**—*Phytopathology*, xxvii, 12, pp. 1152–1160, 3 graphs, 1937.

The viruses of tobacco, aucuba, masked tobacco, and green or yellow cucumber mosaics, severe etch [*R.A.M.*, xvii, p. 126], tobacco ring spot, and latent mosaic, inoculated under controlled conditions in the greenhouse into small, medium-sized, or large Turkish tobacco plants, cause stunting, but the two first-named stimulate protein metabolism to such an extent that the total protein production of the stunted plants exceeds that of the normal ones. All the other viruses used in the tests caused a decrease in total protein production. The extracts of plants infected by the tobacco or aucuba mosaic viruses were found to contain two or three times more protein nitrogen than those of normal material, due to the production of excessively large amounts (3 mg. per c.c.) of high molecular weight protein [ibid., xvii, p. 207], which appears to be closely correlated with the presence of intracellular crystalline deposits absent from individuals inoculated with the non-protein-increasing latent mosaic and ring spot viruses.

Manil (P.). **Une forme nécrosante de la mosaïque du Tabac.** [A form of Tobacco mosaic producing necrosis.]—*Bull. Inst. agron. Gembloux*, vi, 3–4, pp. 186–190, 1 col. pl., 1937. [Flemish, German, and English summaries.]

Inoculations of tobacco plants in the greenhouse with a strain of tobacco mosaic obtained from plants showing necrosed symptoms in the field [cf. *R.A.M.*, xiv, p. 260] showed that it produced more severe symptoms than ordinary mosaic, the leaves becoming covered with large brown lesions and falling off. The white lesions seen in the field did not, however, develop. On *Nicotiana glutinosa* this strain produced only the symptoms of ordinary mosaic.

White Burley plants in the field were then inoculated with both ordinary and necrotic strains of the mosaic virus, with the X and Y viruses, the last two separately and together, with ring spot, with the A virus from potato, and with mixtures of each of the two mosaic strains with X and Y. Only the ordinary mosaic and the Y virus gave rise to systemic infection, the former giving typical symptoms of ordinary mosaic. The ring spot virus gave small, localized lesions. The X virus alone gave whitish spots on the inoculated leaf and those immediately above. Virus A gave no appreciable symptom. The mixture of mosaic with X gave the symptoms of both viruses, and of mosaic with Y only mosaic symptoms. X+Y gave veinbanding and a few X lesions. The strain of mosaic from the necrosed plants, however, gave symptoms exactly resembling those of the white necrotic spotting previously described [loc. cit.]. It is concluded that this spotting is, in most cases at least, due to a strain of ordinary tobacco mosaic, which may, it is considered, be the same as the strain reported in Thung's recent paper [ibid., xvi, p. 414] as causing a necrosed mosaic.

Heierle (E.). **Untersuchung einer unter dem Namen 'Rost' in der Schweiz stark verbreiteten Tabakkrankheit.** [A study of a Tobacco

disease very widely distributed in Switzerland under the name of 'rust'.]—*Ber. schweiz. bot. Ges.*, xlvii, pp. 363–368, 1 fig., 1937.

The name 'rust' is stated to be indiscriminately applied in Switzerland to several widespread tobacco leaf diseases (especially in Ticino), namely, wildfire (*Pseudomonas tabaci*) [*Bacterium tabacum*: *R.A.M.*, xvii, p. 274], angular leaf spot, and a potato virus transmissible to tobacco. The yellow-leaved varieties Mt. Calme jaune and White Burley are the most severely attacked.

The agents of both wildfire and angular leaf spot were isolated on a number of agar media, on which five different colony types developed, viz., (1) round, brown, with dark centre and pale halo, (2) round, uniformly brown, no halo, (3) round, brown, granular, no halo, (4) round, whitish, no halo, and (5) kidney-shaped, white. The microscopic examination of all the colonies revealed a Gram-negative, actively motile rod. In subcultures on beer wort agar, round, milky colonies were formed on the surface, with a more compact, oval to kidney-shaped growth in the submerged portion of the medium. Needle prick inoculation experiments on healthy plants with all types of colony resulted in the development of the characteristic wildfire lesions—olive-green to dark brown, concentric, 1 to 10 mm. in diameter, with a pale halo. In further tests with bacterial suspensions in sterilized tobacco juice at 20° C. and 90 per cent. relative humidity infected plants were killed within a fortnight. *Bact. tabacum* is thus evidently capable of producing either brown or white, angular spots on tobacco in the field according to environmental conditions [ibid., xvi, p. 566]. Observations on 30 varieties in eight localities in 1935 indicated that wildfire was prevalent only in areas that had been under tobacco for some years in succession. The entire absence of disease from one district, supplied like all the others with planting material from Zürich, shows that the stock was sound until infection was contracted in the field.

A virus disease of tobacco foliage characterized by indeterminate white spots without a halo is restricted to plantings in the vicinity of virus-infected potatoes.

No systematic attempts at the control of these diseases have yet been made, but it has been noted that neither wildfire nor the virus develop on tobacco near vineyards sprayed with Bordeaux mixture. Since it is safe to assume that *Bact. tabacum* is introduced on imported seed this should be disinfected with 1 per cent. silver nitrate, while in areas of long-standing tobacco cultivation the seed-bed soil should be sterilized by steam or chemicals.

Clayton (E. E.). **Water soaking of leaves in relation to development of the blackfire disease of Tobacco.**—*J. agric. Res.*, lv, 12, pp. 883–889, 5 figs., 1937 (issued 1938).

Details are given of experiments the results of which showed that tobacco leaves are readily infected by *Bacterium angulatum* [*R.A.M.*, xvii, p. 206], but that under ordinary conditions the progress of the parasite inside the invaded tissues is limited to small areas, large numbers of infections causing but little damage to most types of tobacco. The large, quickly developing lesions characteristic of epidemic blackfire were only produced on leaves that were sprayed with the bacterium

after watersoaking [ibid., xv, p. 537, and loc. cit.] for 48 hours or over; if, however, the watersoaked condition disappeared within a few hours after infection, the development of the disease was abruptly checked. Resistance of tobacco leaves to watersoaking and hence to blackfire was shown to be increased by high topping of the plants, as well as by low nitrogen and high potassium fertilizing.

The results secured in these experiments are similar in every way to those previously obtained with *Bact. tabacum*, but *Bact. angulatum* is evidently the less virulent parasite [cf. preceding abstract].

Pape (H.). **Zur 'Farn- oder Fadenblättrigkeit der Tomate'.** [On 'fern or thread leaf of the Tomato'.]—*Z. PflKrankh.*, xlvii, 12, pp. 619–620, 1 fig., 1937.

Referring to Kotte's recent description of fern leaf of tomato as a new disease for Germany [*R.A.M.*, xvi, p. 715], the writer states that the condition was observed at the Biological Institute, Dahlem, Berlin, on plants of the Lucullus variety as early as 1924, when both July and August were abnormally cool and the former also exceptionally wet.

Baudyš (E.). **Kapradinovitost listů Rajských Jablíček.** [Tomato fern leaf.]—Reprinted from *Prakt. Rádce, 1937*, 10, 2 pp., 3 figs., 1937.

This is a popular account of tomato fern leaf [*R.A.M.*, xvii, p. 78, and preceding abstract] which is stated to have been very prevalent in Czechoslovakia in 1934 and 1935, frequently causing losses of 50 per cent. and more. Control measures are briefly indicated.

Wenzl (H.). **Die Bakterienwelke der Tomaten in Österreich.** [The bacterial wilt of Tomatoes in Austria.]—Reprinted from *Landeskultur, 1937*, 12, 7 pp., 6 figs., 1937.

The writer's investigations in 1936–7 are stated to have shown that the destructive bacterial disease of tomatoes prevalent in Austria for some years past is due to *Bacterium* [*Aplanobacter*] *michiganense* [*R.A.M.*, xvii, p. 80], a semi-popular account of which is given, followed by a discussion of control measures. Several workers have emphasized the high incidence of infection occurring through the wounds inflicted in nipping off young shoots with the fingernail; local observations have further shown that the pathogen very frequently enters the plants through basal leaf scars, while in one instance field tomatoes were found to have been attacked through caterpillar injuries on the roots and stem bases. All varieties cultivated in the Vienna market-garden district appear to be highly susceptible to bacterial wilt, one of the most effective cultural measures against which is the production of hardy plants by the avoidance of excessive warmth and humidity in the early stages of growth.

Pritham (G. H.) & Anderson (A. K.). **The carbon metabolism of Fusarium lycopersici on glucose.**—*J. agric. Res.*, lv, 12, pp. 937–949, 4 graphs, 1937 (issued 1938).

The results of the studies described in this paper showed that the tomato wilt fungus, *Fusarium* [*bulbigenum* var.] *lycopersici* [*R.A.M.*, xvii, p. 139], is as tolerant in pure culture of extremes of hydrogen-

and hydroxyl-ion concentrations as *F. lini* [ibid., v, p. 441], and that the optimum P_H value for growth (4·1) is practically the same for the two fungi. *F. b.* var. *lycopersici* was further shown to have a decided tendency to change the P_H value of both acid and alkaline media towards the optimum, the final P_H in five cases varying only between 4·25 and 4·95. On glucose the organism produced, in addition to carbon dioxide and ethyl alcohol, considerable quantities of volatile and non-volatile compounds, presumably organic acids, part of the carbon in which was determined by new methods. The production of these compounds is an essential point of distinction between this organism and *F. lini* and *F. oxysporum* [ibid., xii, p. 531], probably due to differences in the biological characteristics of the three fungi. With *F. b.* var. *lycopersici* the ratio of the carbon in alcohol to carbon in carbon dioxide is very nearly that required by the equation for a typical yeast fermentation, but, owing to the consumption of the alcohol during the later periods of growth, the ratio gradually decreases with the age of the culture. Ethyl alcohol is definitely used by the fungus as a source of energy as soon as the glucose in the medium is exhausted, and can serve as the sole source of carbon; maximum growth is obtained at a concentration of alcohol approximating to the maximum amount produced on a glucose medium, but concentrations of 4 per cent. or more by volume seriously inhibited the growth of the fungus, and concentrations of 5 per cent. or more completely inhibited it. It does not seem likely that *F. b.* var. *lycopersici* produces alcohol in sufficient quantity to account for its wilting effect on tomatoes, as the maximum concentration obtained was 0·57 gm. per 100 ml.

BEDWELL (J. L.). **Twig blight of Asiatic Chestnuts, especially that caused by Phomopsis.**—*Phytopathology*, xxvii, 12, pp. 1143–1151, 1 fig., 1 graph, 1937.

The writer's investigation of 66,116 Japanese and 8,724 Chinese chestnut trees (*Castanea crenata* and *C. mollissima*, respectively) in 112 plantations in 22 States where they have been introduced to replace *C. dentata*, susceptible to blight (*Endothia parasitica*) [*R.A.M.*, xvi, p. 573], revealed serious damage due to twig blight in young stands, especially on unthrifty trees in poor sites or on those suffering from adverse climatic conditions or from wounds. In 1931 the disease was important in 73 per cent. of the plantations, heavily infecting (up to 90 or 100 per cent.) 56·2 per cent. of the Chinese and 45·2 per cent. of the Japanese trees and killing 13·1 and 12·9 per cent., respectively. The genera of fungi associated with the twig blight included *Phomopsis*, *Sphaeropsis*, *Diplodia*, *Cytospora*, *Diplodina*, *Macrophoma*, *Fusicoccum*, *Dothiorella*, *Phoma*, and *Epicoccum*. Affected trees present a scorched appearance due to the shrivelling and browning of the foliage. In the die-back form of the disease the fungus is arrested at the junction between the secondary shoot and the main stem, when the infected twigs, bearing small, black, erumpent pycnidia arranged singly or in groups, may rot at the base and fall off. In other instances sharply defined, dark to blackish-brown, elliptical cankers, up to 72 mm. in diameter, develop as a result of spread of infection or following injuries to larger branches. Some of these cankers deepen annually

with the formation of concentric zones of callus, and ultimately the branch or bole is completely girdled and dies.

The pathogenicity of pure cultures of two strains of *Phomopsis* (die-back and canker) from *C. crenata* in Virginia was demonstrated by inoculation of wounded Chinese and Japanese chestnuts in the greenhouse. Fifty-three per cent. of the inoculations were successful on dormant trees or those just about to resume activity and only 34 per cent. on those in full leaf, thus bearing out the observation that the period of most rapid growth of the fungus falls between 3rd March and 17th April under natural conditions. Both strains of the fungus were reisolated and produced pycnidia and both A and B spores in culture.

Control should be based on the planting of thrifty, sound stock on good sites, particularly avoiding frost pockets, maintaining vigorous growth by appropriate manuring, and avoiding cutting or pruning injuries.

Renoux. **Le Châtaignier du Japon au pays basque.** [The Japanese Chestnut in the Basque country.]—*Rev. Eaux For.*, lxxv, 12, pp. 998–1066, 2 figs., 1937.

Complete immunity from ink disease (*Blepharospora* [*Phytophthora*] *cambivora*) is stated to be manifested by the Tamba Guri and Shiba Guri varieties of Japanese chestnut (*Castanea crenata*) in the Basque region of Labourd, France [*R.A.M.*, xvi, p. 354].

Servazzi (O.). **Ulteriori prove di preservazione dalle muffe delle Castagne disinfestate con l'immersione in acqua a 50° C. per 45 minuti.** [Further researches on the preservation from moulds of Chestnuts disinfected by immersion in water at 50° C. for 45 minutes.]—*Boll. Lab. sper. R. Oss. Fitopat. Torino*, xiv, 1–4, pp. 46–60, 2 figs., 4 graphs, 1937.

An account is given of experiments during 1935–7, the results of which showed that of all the chemicals tested toluene-p-sulphochloramide of sodium (commonly known under the name chloramide) and a preparation marketed under the designation 'euclorina' (Chemo-pharmaceutical Works Zambeletti, Milan), and also containing this substance, were the most effective in protecting Italian chestnuts, already disinfected for export by immersion for 45 minutes in water at 50° C., against the development of moulds [*R.A.M.*, xvi, p. 140]. It was shown that both chemicals afforded better control of the moulds when added to the cold water in which the chestnuts are placed to cool after treatment than when mixed with the hot water bath; commercial control was obtained with a concentration of 1 in 7,500.

Dowson (W. J.) & Callan (E. McC.). **The watermark disease in the White Willow.**—*Forestry*, xi, 2, pp. 104–108, 1 map, 1937.

White willows (*Salix alba* and '× *viridis*' = *S. alba* × *S. fragilis*) in Cambridgeshire being affected with a condition similar to the watermark disease of the cricket-bat willow (*S. caerulea*) in Essex caused by *Bacterium salicis* [*R.A.M.*, xvii, p. 81], inoculation experiments were made in which *Bact. salicis*, isolated from white willow, was inoculated

into four bat willows with positive results on two of the trees, from one of which the organism was recovered. When *Bact. salicis* from the bat willow was inoculated into two kinds of white willow, one tree of each kind developed severe infection, the organism again being recovered from one of the affected trees. From these results it is concluded that *Bact. salicis* from white willow can cause watermark in bat willow, and vice versa, and that the disease is the same in both kinds of willow and is due to the same organism.

The commonest willows in Essex are *S. caerulea*, while those most frequently found in Cambridgeshire are *S. alba* and its hybrids, many of which have long been diseased over a wide area. Bat willows recently planted in a few places have contracted the disease in the last few years, probably from adjacent white willows, the disease in which is thought to be indigenous in the area concerned; and not to have been derived from Essex. The danger of planting bat willows near affected white willows is obvious.

HILBORN (M. T.). **The anatomy of a black zone caused by Xylaria polymorpha.**—*Phytopathology*, xxvii, 12, pp. 1177–1179, 1 fig., 1937.

In 1933 all attempts to isolate the fungus responsible for the production of a black zone in a red maple (*Acer rubrum*) stump were unsuccessful, but in July, 1937, fruiting bodies of *Xylaria polymorpha* [*R.A.M.*, xii, p. 544] developed on the wood and a similar black zone was found in the adjacent wood, consisting of brown to nearly black, densely aggregated bladder cells occupying the lumina of the fibres and the wood ray cells. The first step in the formation of the black zone is the penetration of the tissue by numerous hyaline hyphae, which later swell and become closely septate. At some point beyond one edge of the zone bladder cell formation commences, and still further in the bladder cells apparently break down, exuding a pigment which stains the surrounding tissue. Finally the pigment dissolves, leaving only the broken bladder cells just outside the other edge of the zone until these in turn disappear. There is thus a progressive movement of the zone line, at any rate in nature. Campbell's theory that the zone line constitutes a 'pseudosclerotium' [ibid., xvi, p. 137] is considered to be more plausible than Hiley's hypothesis that the bladder cells represent enhanced metabolic activity on the part of the fungus (Fungal Diseases of the Common Larch, 1919). No difficulty was experienced in obtaining cultures of *X. polymorpha* from the wood bearing fructifications in 1937, and the failure of similar attempts in 1933 is tentatively attributed to staling, as observed by Brooks and Brenchley in connexion with *Stereum purpureum* infections enclosed by a gum barrier [ibid., x, p. 605].

OGAWA (T.). **Shoot drooping disease of Acer trifidum Hook. et Arn. caused by Pseudomonas acernea n.sp.**—*Ann. phytopath. Soc. Japan*, vii, 2, pp. 125–135, 4 figs., 1937. [Japanese, with English summary.]

Nursery and avenue maple (*Acer trifidum*) trees in Japan are stated to have been suffering for the past 25 years from an epidemic disease characterized by an irregular, water-soaked, later pale Payne's grey

or black spotting of the leaves, which finally turn black and shrivel. The organism isolated from the affected tissues is a rod with rounded ends, 0·5 to 1·2 by 0·2 to 0·6 μ, usually 0·8 by 0·4 μ, aërobic, uniflagellate, non-spore-forming, Gram- and aniline-positive, growing well on a number of standard media, liquefying gelatine, clearing but not coagulating milk, producing some acid but no gas from saccharose, lactose, maltose, dextrose, levulose, galactose, mannite, and glycerine, reducing nitrates to nitrites, and forming hydrogen sulphide. On poured plates of standard agar the colonies are round, smooth, white, glistening, with entire margins; on agar slants the white, filiform streak developing along the inoculated line in 24 hours at the optimum temperature of 32° C. turns citron-yellow in two days. The thermal death point of the organism, which is named *Pseudomonas acernea* n.sp. (group number Ps. 211.2223032), is 59°; all the bacteria on an agar plate were destroyed by $1\frac{1}{4}$ hours' exposure to mid-day sunlight in mid-November. A list is given of 13 other *A.* spp. infected by *P. acernea* in inoculation experiments, which were also positive on *Aesculus turbinata* and *Koelreuteria paniculata*.

LOHWAG (K.). **Fomes hartigii (Allesch.) Sacc. et Trav. und Fomes robustus Karst.** [*Fomes hartigii* (Allesch.) Sacc. & Trav. and *Fomes robustus* Karst.]—*Ann. mycol., Berl.*, xxxv, 5–6, pp. 339–349, 2 figs., 1937.

In connexion with a study of the decay of firs (*Abies pectinata*) by *Fomes hartigii* [*R.A.M.*, xvii, p. 214] and of oaks (*Quercus sessiliflora*) by *F. robustus* [ibid., xvi, p. 221] in Austria, the writer investigated the differences between these two closely related species. *F. robustus* is confined to oaks and chestnuts, whereas *F. hartigii* has been found only on conifers (fir and spruce). The surface of the fruit bodies of both species is brown, but cracks usually develop in course of time on those of *F. robustus*, which are also generally larger than those of *F. hartigii*. Typical of the latter are the numerous superficial pits formed by the exudation of water drops, while the fruit bodies of *F. robustus* are characterized by a well-defined marginal ridge. Hymenial tube formation only commences at a relatively late stage in the development of *F. hartigii* and the individual layers are interspersed with fairly thick strata of tramae which are absent in *F. robustus*. The differential growth of these strata from base to periphery produces a marked difference in shape between the fruit bodies of the two species. *F. hartigii* adheres by its entire base to the substratum, to which *F. robustus*, on the other hand, is only lightly attached. Many of the features attributed by Hartig to *F. igniarius* [ibid., xvii, p. 214] are considered to be more typical of *F. robustus*, the former, for instance, being described as the most common agent of wood destruction on the oak, whereas neither the author nor Bourdot and Galzin (Hyménomycètes de France, 1927) have observed it on this host [but see *R.A.M.*, xv, p. 63].

WEAN (R. E.). **The parasitism of Polyporus schweinitzii on seedling Pinus strobus.**—*Phytopathology*, xxvii, 12, pp. 1124–1142, 2 figs., 1937.

A physiological and pathological study was made of white pine

(*Pinus strobus*) seedlings inoculated with a pure culture of *Polyporus schweinitzii* [*R.A.M.*, xvi, p. 428] originating in a severely infected stand of the same host near Hemlock Lake, New York State. Young seedling growth was found to be adversely affected by a low phosphorus content of the synthetic nutrient solution, but not by a reduction of nitrate nitrogen. Calcium and phosphorus absorption was reduced at P_H 7 in both control and inoculated cultures. Relatively large amounts of calcium compounds were found in the immediate vicinity of the roots, together with a reduced calcium content in the plant ash, denoting that absorption of the element was prevented by the presence of the fungus, the hyphae of which were found penetrating directly through the living cortical cells of the root and through the corky excrescences at the lateral root bases. The pathogenicity of the fungus increased progressively with the alkalinity of the nutrient solution and with reduction in its phosphorus content. Root infection was accompanied by a reddening of the host tissue apparently associated with premature lignification and the development of an acid condition. The parasitism of living seedling roots by *P. schweinitzii* suggests the possible spread of the fungus by nursery stock to forest plantings and implicates it as a factor affecting the natural reproduction of susceptible hosts. In liquid malt cultures *P. schweinitzii* produces succinic acid in amounts capable of increasing the acidity of non-buffered solutions. In buffered solutions the optimum point for growth is P_H 4.

Baxter (D. V.). **Development and succession of forest fungi and diseases in forest plantation.**—*Circ. Univ. Mich. Sch. For. Conserv.* 1, 45 pp., 9 pl., 2 diags., 1 graph, 1937.

This survey of forest diseases in several plantations in Michigan includes the following interesting observations. Adverse site conditions or the attacks of one fungus may often result in a succession of diseases. Diseases favoured by site alone are generally more severe in pure stands than in mixed ones [cf. *R.A.M.*, xvii, p. 278]. Norway spruce (*Picea excelsa*) planted on 'worn out' farm soils in southern Michigan shows a very irregular rate of growth: the maximum and minimum heights in a 29-year-old pure spruce plantation in 1933 were 48·3 and 3 ft., respectively. Stunted trees often show symptoms of chlorosis, but recover eventually after the stand closes. Close spacing of the trees (3×3 ft.) in a pure stand favoured the early appearance of *Stereum sanguinolentum* [ibid., xvii, p. 86]; wider spacing prevented the development of a fungus mat caused by *Peniophora byssoidea*. Spruce planted with locust [*Robinia pseud-acacia*] exhibits a very rapid growth, leading to great injury or even total loss owing to the formation of deep frost cracks, which leave the heartwood open to infection by heart rot fungi, e.g., *P. gigantea* [ibid., xvii, p. 1].

White pine [*Pinus strobus*] planted on 'worn out' farm lands in southern Michigan, where there is an impervious layer of clay below the surface, is subject to root rot (*Polyporus schweinitzii*) [see preceding abstract] at an early age. Scots pine [*Pinus sylvestris*] is more readily attacked by the gall rust [? *Cronartium cerebrum*: ibid., xv, p. 331] when planted on the cut-over jack pine plains of the north of Michigan than in the hardwood belt of the south. *P. ponderosa*, lodgepole pine

[*P. contorta*], and Austrian pine [*P. nigra*] planted on the jack pine (*P. banksiana*) plains are so badly infected by *C. comptoniae* [ibid., xii, p. 543] that practically every tree is killed. Only young trees of *P. ponderosa* planted in southern Michigan were infected by *Coleosporium solidaginis* [ibid., xiv, p. 364]. Jack pine and Norway pine [*P. resinosa*] are likely to suffer longer from *Lophodermium pinastri* [ibid., xiv, p. 663] when planted on the northern plains than in the hardwood region. Canker of *P. resinosa* caused by *Tympanis pinastri* [ibid., xiv, p. 612] is reported for the first time in the Great Lakes region, where at least 86 per cent. of the trees in one stand were affected by it.

MIELKE (J. L.). **An example of the ability of Ribes lacustre to intensify Cronartium ribicola on Pinus monticola.**—*J. agric. Res.*, lv, 12, pp. 873–882, 1 map, 1 graph, 1937. [Issued 1938].

The results of a study over a number of years on the intensification of white pine blister rust (*Cronartium ribicola*) [*R.A.M.*, xvii, p. 143] on a 45-acre plot of western white pine (*Pinus monticola*) near Revelstoke, British Columbia, where *Ribes lacustre* is the only species of *Ribes* present, indicated that this alternate host of the rust constitutes a far greater menace to *P. monticola* than was hitherto assumed. The eradication of *R. lacustre* from the neighbourhood of pine stands is therefore strongly advocated.

DAY (W. R.). **The dying of Larch: a note on Professor E. Münch's monograph 'Das Lärchensterben'.**—*Forestry*, xi, 2, pp. 109–116, 1937.

In this critical discussion of Münch's recently published papers on larch die-back [*R.A.M.*, xvi, p. 76; see also xvii, p. 214], usually associated in Germany with the cankers due to *Dasyscypha willkommii* (= *D. calycina*), the author states that there would appear to be no reason as yet for not accepting Langner's general conclusions that the fungus plays a secondary but definite and necessary part in the canker development [ibid., xv, p. 693]. The author's work in Britain has revealed such a close connexion between the development of small cankers four to five years of age and frosts occurring during the period of active metabolism, that there appears to be no doubt that in Britain at least frosts in late winter, spring, and autumn commonly initiate and continue canker development. Münch and his school bring the fungus too compulsorily into the continued growth of the cankers, and dismiss too lightly the point of view of those who associate susceptibility to disease with wrong treatment and wrong choice of habitat. While it is of fundamental importance to recognize the true cause of a die-back or canker, it is equally important to see that other conditions affect the growth and health of the tree and may markedly affect the tendency of the tree to succumb to or recover from frost injury, whether this is aggravated by fungus infection or not. The solution of the larch problem is to be sought by fitting race of tree to habitat, and in this connexion it is stated that the Scottish larch is well worth propagating in suitable localities in Britain.

Gaisberg (Elisabeth v.). **Die Adelopus-Nadelschütte der Douglasie dargestellt auf Grund der bisher hierüber erschienenen Untersuchungen.** [The *Adelopus* needle-fall of the Douglas Fir described on the basis of the studies hitherto published on it.]—*Biologe,* vi, 12, pp. 385–388, 1 fig., 1937.

This is an abridged account of the available knowledge concerning the needle-fall of Douglas firs (*Adelopus gäumanni*), with special reference to the writer's observations in Württemberg, Germany, together with a note on *Rhabdocline pseudotsugae* on the same host. Full particulars of the work have already been noticed from another source [*R.A.M.*, xvii, p. 84].

Storch (K.). **Ueber den Abbau des Fichtenholzes durch den Rotfäulepilz (Polyporus annosus).** [The degradation of Spruce wood by the red rot fungus (*Polyporus annosus*).]—*Papierfabrikant,* xxxv, 49, pp. 485–492, 1 graph, 1937.

The author describes and tabulates the results of his analytical examination of samples of 60- to 120-year-old spruce wood from various parts of Germany and discusses the data in respect of degradation by *Polyporus* [*Fomes*] *annosus* [see above, p. 282] in the light of contemporary studies. The fungus renders the wood soluble in 15 per cent. sodium hydroxide, solubility increasing parallel with advancing disintegration. Chemically the decayed wood is very similar to sound material. Both lignin and carbohydrates are destroyed by the fungus, the mycelium of which was found to contain an abnormally high proportion (24 per cent.) of extractives as compared with the xylem (2 per cent.). Degradation of the cellulose is probably effected by depolymerization in Staudinger's sense (*Zellstofffaser,* xxxiii, p. 153, 1936), involving the gradual disappearance of the high molecular components and a consequent reduction not only in the yield but in the quality of the fibre.

Waterston (J. M.). **Cedar disease survey. General review of diseases and pests.**—*Agric. Bull. Bermuda,* xvi, 10, pp. 50–55, 1937.

Cedars (*Juniperus bermudiana*) in Bermuda are affected by a dry heart rot caused by a fungus as yet unidentified, which enters the tree through an old wound, and spreads longitudinally and radially in the heartwood as white, papery sheets which later turn dark buff. The diseased wood is darker brown than the rest of the heartwood, and tends to crack at right angles to the grain, as a result of which it finally splits into small rectangular pieces which lie loosely in the central cavity. In many cases the damage remains unseen until the tree is cut up. Trees 50 to 250 years old are affected, and apparently the disease is commonest on trees the felling of which has been unduly delayed. The affected trees lose their commercial value and are readily blown down. The condition is controlled by the usual surgical methods.

The same host is also attacked by rust (*Gymnosporangium bermudianum*) [*R.A.M.*, xv, p. 412], and the pathogenicity of a species of *Pestalozzia* and of one of *Phomopsis* found on dead and dying branches [ibid., xv, p. 413] is under observation.

Bongini (Virginia). **Seccume della Cryptomeria. (Nota preliminare.)** [Desiccation of *Cryptomeria*. (Preliminary note.)]—*Boll. Lab. sper. R. Oss. Fitopat. Torino*, xiv, 1–4, pp. 19–31, 2 pl., 4 graphs, 1937.

A brief account is given of a serious outbreak of a disease in young rooted cuttings of *Cryptomeria japonica* var. *elegans* which was first noticed during the winter of 1935–6 in municipal nurseries in Turin and which by October, 1936, had spread to and killed several hundred of the cuttings. Other species of *Cryptomeria* growing in close proximity to the diseased plants also showed signs of infection in 1937. The main symptoms are the yellowing and partial desiccation of the needles, starting either from the tip or from the base, partial drying-up from the base upwards of the primary ramifications arising in the leaf axils, and yellowing and total desiccation of the secondary branches lower down on the main stem; the drying-up process may eventually reach the top parts of the plant, and result in its death. Diseased cuttings showed the constant presence of a species of *Cladosporium* which is referred to *C. laricis* [*R.A.M.*, ii, p. 297] and of polymorphous pycnidia referable to the genus *Phomopsis*, suggesting a genetic connexion between the two organisms. While the evidence would indicate that the condition is caused by one or both of these fungi, attempts to reproduce it experimentally have so far given negative results.

Cartwright (K. St. G.). **Timber-stain in Norway Spruce.**—*Forestry*, xi, 2, p. 124, 1 pl., 1937.

With reference to a statement by H. Meyer-Wegelin in his work 'Ästung' (see *Forestry*, xi, 1, p. 59, 1937) that the live pruning of Norway spruce [*Picea excelsa*] is often followed by decay, the author points out that he has frequently observed red stain followed by white rot in Norway spruce poles due to *Stereum sanguinolentum* [see above, p. 359], there being strong evidence that infection had occurred in the standing tree. Since many species of *Stereum* attacking the wood of the living tree effect their entry through broken branches, the author considers it highly probable that the decay referred to by Meyer-Wegelin may be largely due to *S. sanguinolentum.*

Robertson (W. A.). **Report of the Director of Forest Products Research for the year 1936.**—*Rep. For. Prod. Res. Bd, Lond., 1936*, pp. 3–57, 4 pl., 7 graphs, 1937.

The following are among the items of phytopathological interest occurring in this report [cf. *R.A.M.*, xvi, p. 290]. The collection of fungi maintained in pure culture at the Forest Products Research laboratory now includes 235 species of wood-destroying fungi as well as a number of staining organisms.

The computations involved in the treatment of 4,400 railway sleepers [ibid., xv, p. 185] have now been completed. Baltic redwood [*Picea excelsa*] sleepers are generally creosoted by a full cell process, but a much better distribution results from injection by the empty cell process, by which the sapwood can be completely impregnated without being saturated, while at the same time the treatment can be continued until the heartwood faces of the sleepers are sufficiently

penetrated. An even deeper and more uniform penetration of the heartwood results if the faces are incised. The more uniform absorption obtained by the empty cell method reduces the number of imperfectly impregnated sleepers and hence the cost of track maintenance.

Confirmatory tests on the impregnation of Douglas fir [*Pseudotsuga taxifolia*] sleepers demonstrated that sleepers treated on arrival, at a moisture content of 27 per cent., absorbed 33 per cent. more creosote than similar sleepers seasoned for 9 months to a moisture content of 20 per cent. It appears that the moisture content of the surface of the timber becomes much more important than the average value for the whole sleeper, and that when the surface has dried much below 25 per cent. moisture content the penetration of the creosote may be retarded. Irregular penetration of creosote in New Zealand beech (*Nothofagus menziesii*) was ascertained to be due to the localized development of tyloses and gum-plugging of the pores.

The results of periodic examination of experimentally treated fence posts erected in 1932 indicated that charring the posts has very little preservative effect, though if the charred posts are dipped in creosote the preservative effect is greatly increased; tarring appeared to be of little value.

Zinc oxide paints were less liable to mould than white lead paints [ibid., xvi, p. 291; xvii, p. 195]. A simple method was devised of testing the fungicidal efficiency of paints, the fungus being cultivated on wood pulp mats soaked in malt extract, and the paint applied to the mats when these were covered with the mould; observations were then made on the ability of the fungus to penetrate the paint.

A study of the conditions influencing the fructification of Basidiomycetes in culture showed that an agar containing 2 per cent. dextrose and 1 per cent. peptone was a very satisfactory medium. Some species grew on media containing up to 10 per cent. peptone. Sterilized wheat or oat grains soaked and allowed to germinate before autoclaving gave vigorous growth and well-developed fructifications. The general conclusion reached is that some species, e.g., *Collybia velutipes*, *Schizophyllum commune*, and *Armillaria mucida*, form fruit bodies on almost any medium, whereas others, e.g., *A. mellea* and many species of *Fomes*, remain sterile on all media. For some species the optimum length of daily exposure to light for vegetative growth and fructification depended on the concentration of nutrients in the medium. Some fungi are extremely sensitive even to very brief exposure to subdued light. Decay of a floor was reported as due to *Fomes roseus* [ibid., xvi, p. 646], which is uncommon in England, and was probably present in the timber when it was imported.

Deterioration of timber caused by fungi. Part 2. Staining fungi.—*Trade Circ. For. Prod. Aust.* 38, 10 pp., 4 figs., 1936. [Received December, 1937.]

The commonest sap stain of timber in Australia is the blue stain of the sapwood of pines [*Pinus* spp.] caused by several species of *Ceratostomella*. A deep yellow stain of the sapwood, probably caused by a mould, is somewhat common in some of the light-coloured kinds of *Eucalyptus*; generally found in fire-killed trees felled about two years

after death, it also occurs in trees injured in other ways. Australian hardwoods are also subject to yellow staining caused by *Penicillium divaricatum* [*Paecilomyces varioti*: *R.A.M.*, xvi, p. 575]. Staining organisms do not develop in wood with a moisture content of less than approximately 20 per cent., and their growth becomes progressively slower at temperatures above 85° and below 75° F. The paper concludes with recommendations for prevention and control by rapid drying and chemical treatments, respectively.

REINKING (O. A.) & HUMPHREY (C. J.). **Some fungi found decaying railway ties of native woods in Honduras.**—*Plant Dis. Reptr*, xxi, 20, pp. 357–359, 1937. [Mimeographed.]

A list is given of 22 different fungi belonging to 4 families (mostly Polyporaceae) found in 1922 and 1934 near Tela, Honduras, causing decay of railway sleepers made of native woods.

CHUPP (C.). **The effect of temperature and moisture on vegetable diseases in New York State in 1937.**—*Plant Dis. Reptr*, xxi, 17, p. 320, 1937. [Mimeographed.]

During August, 1937, the weather in New York state was hotter and wetter than ever previously recorded, and the following observations *inter alia* were made on its effect on disease. Though heavy rain usually favours cucurbit infection by *Cladosporium cucumerinum* [*R.A.M.*, xvi, p. 655], the fungus had not been found by September, probably owing to the heat. *Phytophthora infestans* began to cause widespread infection of potatoes and tomatoes, but high temperatures at night checked the disease, except in the extreme north. There was no record of [tomato] spotted wilt affecting pepper [*Capsicum annuum*] anywhere in the state, although in 1936 California Wonder peppers showed almost 100 per cent. infection [cf. ibid., xv, p. 65]. Celery was severely affected by *Cercospora apii* [ibid., xvi, p. 584] in fields where dusting or spraying had been neglected; less blight (*Septoria* spp.) [*S. apii*: loc. cit.] was, however, present than usual. Muskmelons were everywhere affected by *S. cucurbitacearum* [ibid., xi, pp. 159, 745], though the disease is generally rare, and were also attacked much more severely than usual by *Alternaria cucumerina* [ibid., xiv, p. 182].

KADOW (K. J.) & ANDERSON (H. W.). **Damping-off control: an evaluation of seed and soil treatments.**—*Bull. Ill. agric. Exp. Sta.* 439, pp. 291–384, 9 figs., 1937.

Field and greenhouse studies [which are fully described, and the results of which are tabulated] carried out in Illinois from 1932 to 1936, inclusive, on the control of damping-off of vegetable seedlings [*R.A.M.*, xvi, p. 659] showed that about 80 per cent. of the local infections are due to *Pythium* species, and 15 per cent. to *Rhizoctonia* [*Corticium*] species, while in a few cases the disease is due to *Botrytis* or *Fusarium* spp.

The chief variables affecting the pre-emergence phase (much more serious than the post-emergence phase) were soil moisture and tempera-

ture. High humidity and high temperature were the main factors during post-emergence, though soil moisture was also important.

Of the treatments tested, cuprous oxide was very injurious in soils of P_H over 5, though soil acidity had no effect on control by semesan or vasco 4 under similar conditions. Heavy rains after planting reduced the value of semesan as a seed treatment. Colour was a less accurate indication of the fungicidal efficiency of the different cuprous oxides than copper content and adhesiveness.

In limited tests on spinach [ibid., xvii, p. 219] cuprocide, semesan, and vasco 4 gave better control when the disease was due to *Corticium* than when it was caused by *Pythium*; in either case, effectiveness decreased in the above order. No seed treatment gave effective control in a susceptible crop under conditions highly favourable to infection, but under ordinary growing conditions seed treatment was as effective as soil sterilization. Under the experimental conditions, the following treatments (arranged in descending order of effectiveness) gave satisfactory control for lettuce, endive, carrots, beet, Swiss chard [*Beta vulgaris* var. *cicla*], muskmelon, watermelon, cucumber, tomato, pepper, and egg-plant, viz., cuprous oxide, copper sulphate soak, and semesan (the last for crops under glass and watered lightly); for squash copper sulphate soak and cuprous oxide; for cabbage, kale, and kohlrabi zinc oxide (specially prepared for seed treatments, as in vasco 4, leafox, or AAZ Special), or semesan (better than the foregoing for crops under glass, and watered lightly); for peas cuprous oxide; for spinach cuprous oxide, zinc oxide (as above), copper sulphate soak, or semesan (for crops under glass, watered lightly). No treatments are recommended for beans, leeks, onions, or parsnips, and treatments for radishes and turnips are of doubtful value.

The post-emergence phase may be controlled by two or three applications of Bordeaux mixture at three-day intervals.

Recommendations are briefly given as to suitable cultural practices, and the paper concludes with a list of the precautions to be adopted in utilizing the control measures described.

[The practical recommendations given in this paper are embodied in *Circ. Ill. agric. Exp. Sta.* 481, 1937.]

SINGALOVSKY (Z.). **Étude morphologique, cytologique et biologique du mildiou de la Betterave (Peronospora schachtii Fuckel).** [A morphological, cytological, and biological study of Beetroot mildew (*Peronospora schachtii* Fuckel).]—Thèses, Fac. Sci. Univ. Paris, Sér. A, 358, pp. 552–618, 40 figs., 7 graphs, 1937.

This is an exhaustive study [described in detail] of the morphology, cytology, and biology of beet downy mildew (*Peronospora schachtii*) [*R.A.M.*, xi, p. 419; xv, p. 764]. The author found that the mycelium can invade the entire plant, including the whole root and the perivascular cells, and was occasionally present in the vessels. The thickening of the infected leaves results from cellular hypertrophy rather than hyperplasia, and this hypertrophy is more marked in the cells of the spongy mesophyll than in those of the palisade tissue. The histological changes induced did not vary greatly with the different species and varieties of beets examined. The affected leaves show marked reduction

in chlorophyll pigments, but only small cytological differences were observed between healthy and infected cells. In the latter the starch content of the chloroplasts was greatly reduced.

Conidial germination takes place at temperatures ranging from 0·5 to 28°–29° C., and reaches its optimum (72 per cent. germination at the end of six hours) at about 10°.

In artificial inoculations in the field the incubation period was about nine days, and the evidence obtained showed that susceptibility depended mainly on the plants being in an early stage of development when exposed to infection, temperature being only of secondary importance unless very high or very low. Field observations over a period of 18 months showed that new invasions occurred only between 5° and 20°.

The amount of damage caused by the disease also depends on the stage of development reached by the plant when infected, late infections inducing sterility of the flowers. In a test in which a large number of commercial varieties were exposed to natural and artificial infection, only two failed to take the disease, viz., the so-called 'Rouge demi-longue à feuillage noir' and Yellow Tankard. The wild species *Beta maritima* showed nearly 40 per cent. natural infection.

BUCHHOLTZ (W. F.). **A severe case of Rhizoctonia root rot of Sugar Beets after Potatoes.**—*Phytopathology*, xxvii, 12, p. 1180, 1 fig., 1937.

A severe case of late canker root rot of sugar beets grown in an area at Kanawha, Iowa, occupied by potatoes in 1934 was observed in 1935. Adjoining the potatoes had been a barley field, some of which was also covered by the beets, but here there was scarcely any rot (1·6 as compared with 50 per cent. on the potato ground). The only fungus isolated from decayed beets was *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xvii, p. 153].

PALM (B. T.). **The 'cracked skin' disease of the Beet (Beta vulgaris L.).**—*Svensk bot. Tidskr.*, xxxi, 5, pp. 395–399, 1 fig., 1937.

During the harvest seasons of 1934 and 1935 the writer examined a large number of abnormally small, dark brown to black beets, the cortex of which, especially near the crown, bore cracks running downwards parallel to the main axis of the root. No pathogenic organism was isolated from the diseased material. A survey of fodder beet fields led to the detection of a similarly affected plant with erect, brittle, exceptionally narrow leaves, tapering towards the petiole, while the older foliage showed numerous coal-black, necrotic, irregularly distributed lesions. Presumably these foliar symptoms were causally connected with the cracked surface of the roots. On drying, the affected leaves turned coal-black instead of the normal light brown. The disorder appears to be very uncommon in Sweden, but an identical or closely similar trouble has been observed at the Kleinwanzleben (Germany) Sugar Beet Experiment Station. The 'cracked skin' disease of beets presents many analogies with dahlia stunt [*R.A.M.*, xvii, p. 114], both being in all probability of virus origin.

PANASSYUK (M. P.). Основные выводы научно-исследовательских работ ВНИС'а за 1936 год. [Main results of the scientific research work during 1936 of the Pan-Soviet Scientific Research Institute for the Sugar Industry.]—285 pp., 38 figs., 6 graphs, Держ. Видавн. Колгос. i Радгос. Лiтер. УССР. [Ukr. Publ. Off. Collect. & Co-op. Fmg Lit.], Kieff, 1937.

This is a collection of summarized reports of officers of the Scientific Research Institute for the Sugar Industry in the Ukraine of the results obtained in 1936 in the investigations on the more outstanding agricultural and technical problems of the industry. The following items are of phytopathological interest. According to E. F. Zaparenko (pp. 131–132), *Cercospora* [*beticola*] on sugar beet was more severe in 1936 than in 1935, especially in districts where high air temperatures coincided with relatively heavy rainfall during the critical period for infection; hot and dry conditions had a marked controlling effect on the disease, but artificial irrigation of the fields tended to increase the incidence and intensity. All the evidence indicated that the severity of the outbreaks was not related to the amount of leaf spot present in the locality in the preceding year, but to temperature and moisture which are apparently the decisive factors. Mme N. I. Salunskaya (pp. 133–134) states that laboratory and field tests during two years showed that various forms of sulphur and polysulphides gave no appreciable control of *C. beticola*; very adequate control, on the other hand, resulting in an increase of 8 to 20 per cent. in yield of sugar, was afforded by three or four timely applications of 1 per cent. Bordeaux mixture at the rate of 600 to 800 l. per hect., or three or four dustings with copper meritol at the rate of 20 kg., or copper-lime dust at the rate of 40 kg. per hect. Very promising results were also obtained with 1 per cent. emulsions of naphtha by-products containing 1·5 to 2 per cent. copper. The results of preliminary tests indicated that in certain localities the severity of *C. beticola* outbreaks was considerably reduced by applications of nitrogen and potassium to the beet seedlings at the two- and six-leaf stages; the effect of the fertilizers was greatest when they were applied in liquid form. Z. A. Pozhar (pp. 134–135) found in greenhouse experiments that the length of the incubation period of *C. beticola* was largely determined by temperature; it was shortest (9 days) at temperatures averaging 17·8° C., with a night minimum not below 10° and a day maximum not above 30°; at average temperatures of 16·1°, 19°, and 26° the incubation period was 13, 10, and 15 days, respectively. Air humidity had no effect on the incubation period, but was the decisive factor in determining the intensity of attack; in beet plants kept at 60 per cent. relative humidity, infection with *C. beticola* resulted in the formation of only 5 leaf spots per plant on the sixth day from inoculation, while in plants kept at 91 to 100 per cent. relative humidity the corresponding number of spots was 3,515. In leaves inoculated when physiologically mature, the incubation period was from one to six days shorter than in leaves inoculated at younger stages of development.

According to Mme Salunskaya, N. I. Gomolyako, T. D. Logvinenko, and A. I. Nassonoff (p. 136) effective control of *Rhizoctonia* root rot was afforded by steeping the beetroots before planting for seed

production in 1 in 300 commercial formalin and keeping them covered for two hours, or by dipping them for 5 minutes in 1 in 10 lime-sulphur or 0·25 per cent. germisan; all the other fungicides tested were either ineffective or injurious to the hosts. The causal fungus was found in the field on the weeds *Cirsium arvense*, *Solanum nigrum*, and *Capsella bursa-pastoris*.

O. I. Kotchura and T. D. Logvinenko (pp. 136–137) distinguish two types of sugar beet scab, namely, 'pimply scab' caused by bacteria, which is being studied, and the 'zonal or common scab', the causal organisms of which have been identified as *Actinomyces scabies* [*R.A.M.*, xiv, p. 340], *A. nigrificans*, and *A. cretaceus*. The second type is fairly widespread, especially in the beet-growing districts to the east from the Dnieper. Dressing heavily infected soil with sulphur at various rates or with 8 metric tons of lime per hect. had no appreciable controlling effect on the common scab, but in a few cases calcium cyanamide at the rate of 400 kg. per hect. reduced the incidence of the disease by about 15 per cent.

K. I. Vitas (pp. 137–138) states that he succeeded in obtaining pure cultures of *Rhizoctonia violacea* [*Helicobasidium purpureum*: ibid., vi, p. 756 *et passim*] by transferring young, heavily tomentose 'infection cushions' [loc. cit.] from infected beetroots to various media, among which beer wort agar and beer wort meat agar were very favourable to the growth of the fungus. T. P. Odaritch (p. 138) states that while negative results were obtained from attempts to immunize sugar beets against *C. beticola* and seedling root rots by Arnaudi's and Carbone's methods [ibid., xiii, p. 318; xvii, p. 55], vaccination of the roots with filtrates from attenuated cultures of *Fusarium culmorum* reduced the storage rot caused by this fungus by 31·44 per cent. S. F. Morotchkovski (pp. 139–140) gives a list of 26 species or varieties of *Fusarium* which were isolated from beetroots stored in silos, eleven of which are stated to be new records on this host; the pathogenicity of the following to stored beets was experimentally established, namely, *F. culmorum* [ibid., xv, p. 765], *F. oxysporum* var. *aurantiacum*, *F. oxysporum*, *F. beticola*, *F. coeruleum*, *F. angustum*, and *F. bulbigenum* var. *blasticola*. A list is also given of 24 species of *Penicillium* [including five species named as new to science by the author, without Latin diagnoses] which have been found causing rots in stored beetroots, and of these *P. expansum*, *P. stoloniferum*, *P. rubrum*, and *P. bordzilowskii* n.sp. were shown to be the more active pathogens. Investigations in western Siberia showed that beet seedling root rot there is associated with 15 species of fungi, which are listed, including *Phoma betae*, *Alternaria tenuis*, and various moulds, among which *Acrothecium* sp., *Actinomucor repens*, and *Zygorrhynchus moelleri* are stated to be new records on beet.

Service and regulatory announcements. July–September 1937.—*S.R.A., B.E.P.Q.* 132, pp. 230–253, U.S. Dep. Agric., 1937.

Summaries are given of the plant quarantine import restrictions in force in New Zealand, Presidency of Dominica, Dominican Republic, France, Germany, the Gambia, St. Vincent, Yugoslavia, Turkey, Tanganyika, Surinam, Nigeria, Bermuda, Nyasaland, China, and the Federated Malay States.

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Disease resistance in French Beans.—*Fruit World, Melbourne*, xxxviii, 12, p. 24, 1937.

In a crop-growing competition in New South Wales French beans [*Phaseolus vulgaris*] of the Burnley selection of Canadian Wonder, a variety which has been widely planted locally because of its alleged high resistance to bacterial blight [*Bacterium phaseoli*], while showing some resistance to the disease, were more susceptible to other disorders, including anthracnose [*Colletotrichum lindemuthianum*] and mosaic, than Tweed Wonder growing in adjacent plots. Growers are strongly advised not to sow a large area with any much-advertised new variety until they have determined by a small test whether it is suitable to their local conditions.

Walker (J. C.). **Onion diseases and their control.**—*Fmrs' Bull. U.S. Dep. Agric.* 1060, 24 pp., 15 figs., 1937.

A popular description (preceded by a descriptive key) is given of the symptoms, distribution, and control of fungous, bacterial, virus, and physiological diseases and injuries of the onion, which occur either in the field or in storage.

Rosella (E.). **La maladie du collet de la Laitue, ses causes et ses remèdes.** [The collar disease of Lettuce; its causes and its control.] —*Progr. agric. vitic.*, cvii, 21, pp. 496–497; 22, pp. 514–515; 23, pp. 537–539, 1937.

The cultivation of lettuce over the whole of the Mediterranean seaboard of France is stated to be greatly menaced by the prevalence there of the collar rot caused by *Sclerotinia libertiana* [*S. sclerotiorum*: *R.A.M.*, ix, p. 759; xvii, p. 290], although it is believed that *S. minor* [ibid., xvi, p. 652] may also be responsible for the condition during the colder season, namely December–January. In discussing control measures, stress is laid on the inadequacy of crop rotation, owing to the polyphagous nature of the fungus and its suspected saprophytic abilities, and also on the practical difficulties of soil disinfection with chemicals. Observations indicated that seedlings replanted from seed-beds are particularly susceptible to the rot, possibly owing to the fact that the stable manure used for the beds offers a favourable substratum for

the initial development of the fungus. The losses caused by the disease may be minimized by increasing the resistance of the plants by well-balanced manuring, and by avoiding stagnation of water between the rows after watering. A brief reference is made to a strain of 'Batavia blonde' lettuce developed by Labrousse, which is stated to be completely immune from the collar rot caused by *S. sclerotiorum.*

WEISE (R.). **Der Spargelrost und seine Bekämpfung.** [Asparagus rust and its control.]—*Kranke Pflanze*, xiv, 12, pp. 205–208, 1937.

A semi-popular account is given of the symptoms, life-history, and control of asparagus rust (*Puccinia asparagi*), a destructive outbreak of which occurred in Saxony [*R.A.M.*, xvi, p. 238] in the summer of 1937. Most of the information here presented has already been noticed from other sources, but mention may be made of potash deficiency as a possible contributory factor in rust development, and of the susceptibility to the disease, not only of the reputedly immune American varieties but also of the German commercial line, Geo, though the latter shows a slight degree of resistance in the Weinböhla district.

MOGHILEFF (L. M.) & RYAKHOVSKI (N. A.). Сорта Чечевицы, устойчивые к увяданию. [Varieties of Lentils resistant to wilt.]—*Pl. Prot., Leningr., 1937*, 14, pp. 110–111, 1937.

Wilt of lentils caused by the fungus *Botrytis cinerea* [*R.A.M.*, viii, p. 289] is of comparatively recent occurrence in the U.S.S.R., where it is particularly severe in fields where lentils are preceded by sugar-beet. In field-plot tests carried out in 1936 with 18 varieties of *Lens esculenta* subsp. *macrosperma*, the following varieties selected by the Belaya-Tzerkoff Station showed the greatest resistance to the disease: variety 012 showed 0·0 per cent. of infection, 016 6·7 per cent., 017 2·7 per cent., and 021 1·3 per cent. The earliest ripening variety was 016, and the highest yield was given by 03 (slightly susceptible, 5·3 per cent. infection) selected by the same station.

GALATCHYAN (P. M.). Этиология „зеленой пятнистости" Огурцов в условиях Ленинградской области как обоснование мер борьбы с нею. [The etiology of green spotting in Cucumbers under conditions in the Leningrad region as a basis for control measures.]—*Pl. Prot., Leningr., 1937*, 15, pp. 44–56, 1937. [English summary.]

A detailed description is given of the symptoms of green spotting of cucumber which affects both leaves and fruit of plants grown under glass in the Leningrad district; leaf infection, however, often occurs independently of fruit infection. Of the micro-organisms associated with the disease, *Bacterium lacrymans* [*R.A.M.*, xv, p. 553] was shown by experimental infections to be the primary parasite, whereas *Cladosporium herbarum*, of which eight different races were found, is merely a secondary invader. The author regards *C. cucumerinum* [ibid., xvii, p. 155] as synonymous with *C. herbarum* and *Scolecotrichum melophthorum* [ibid., vii, p. 6] as belonging to the genus *Cladosporium*. For plants grown under glass the minimum temperature for infection with *Bact. lacrymans* is 0° C., the optimum 23 to 28·5°, and the maximum 33·5 to 36·5°. Field experiments established that the disease can be transmitted

through the soil and plant debris, since crops raised on soil previously planted with cucumbers showed 30 per cent. or more infection, whereas on new soil there was no disease apparent. The disease is also believed to be transmitted by the seed.

Porter (D. R.). **Breeding high-quality wilt-resistant Water-melons.**—*Bull. Calif. agric. Exp. Sta.* 614, 43 pp., 14 figs., 1 graph, 1937.

In breeding work [which is fully described, and the results of which are tabulated] against watermelon wilt (*Fusarium* [*bulbigenum* var.] *niveum*) [*R.A.M.*, xvi, p. 439; xvii, p. 290] in California the genes for resistance were found to be carried by the susceptible commercial varieties Klondike and Grey Monarch. Continued propagation of resistant stock of these varieties has resulted in strains resistant enough to produce profitable crops in severely infested soil. Hybrids of Klondike with Pride of Muscatine or Iowa King were of inferior market qualities to hybrids from crosses of Iowa Belle with Klondike. Klondike R 7, the new resistant variety released in February, 1937, representing the F_7 generation of cross 67 obtained in 1930 by crossing Iowa Belle with Klondike, differs from commercial Klondike in fruit type, skin sutures, skin colour, and reaction to wilt; it is recommended for any locality for which Klondike has been found suitable.

Auchinleck (G. G.). **Report on the Department of Agriculture, Gold Coast, for the year 1936–37.**—21 pp., 1937.

In the section of this report dealing with the work of the botanist [T. L. Williams] (pp. 13–14) it is stated that in further breeding experiments against cassava mosaic [*R.A.M.*, xvii, pp. 161, 297] resistant seedling types tested included four (C 50, C 32, C 192, and C 282 A) bred from known parents and two natural seedlings (M 11 and M 14). Of these, the first three were obtained by crossing Calabar Seedling 34 with Sareso Seedling 22, and the fourth by crossing Calabar Seedling 54 with Calabar-Red Seedling 14, while the remaining two originated from Calabar Seedling 34. The first four were thus second-generation seedlings from tested parents. The percentages of the seedlings that became infected (average of four stations) were 8·2, 18·4, 8·2, 12·2, 60·4, and 23·4 for C 50, C 32, C 192, C 282 A, M 11, and M 14, respectively; C 282 A gave the highest yield and was the most palatable. It is being retained, together with C 50, for further tests.

Medidas para combatir la enfermedad de las plantas de Chile, llamada marchitez. [Means of combating the disease of Chilli plants known as wilt.]—*Agricultura, Mexico*, i, 2, p. 40, 1 fig., 1937.

The following measures are advocated for the control of chilli [*Capsicum annuum*] wilt caused by *Fusarium annuum* [*R.A.M.*, xiv, p. 7] in Mexico: crop rotation for a minimum period of four years, use of seed from resistant varieties, and seed disinfection by ten minutes' immersion in a 3 in 1,000 formalin solution, covering with a sack for one hour, and drying for 24 hours before sowing.

Rudolph (B. A.) & Snyder (W. C.). **Verticillium wilt of Pepper.**—*Plant Dis. Reptr*, xxi, 22, p. 404, 1937. [Mimeographed.]

Tissue platings from two sets of diseased chilli pepper (*Capsicum*

annuum) plants of the Anaheim and Mexican varieties in southern California in every case yielded a *Verticillium* apparently agreeing with *V. albo-atrum* [*R.A.M.*, ix, p. 677; xi, p. 745; xii, p. 117, and next abstract]. In the field the lower leaves of the affected plants dropped off, and the edges and tips of those that remained attached were burned or brown. When the healthy cortex was cut away, the vascular cylinder showed a marked brown discoloration. The field of Mexican chilli was in its fifth year of peppers and showed about 20 per cent. loss, while the Anaheim field was in its second consecutive year and showed about 1 per cent. loss. There appears to be no previous record of *Verticillium* wilt of chillies in the United States.

DUNLAP (A. A.). **Rust on Teosinte and wilt of Pepper in Connecticut.**—*Plant Dis. Reptr*, xxi, 23, p. 426, 1937. [Mimeographed.]

Puccinia sorghi [*P. maydis*] was found on *Euchlaena mexicana* [*R.A.M.*, xiii, p. 573] growing near affected maize in Connecticut. *Capsicum annuum* in a few widely separated fields in the same State developed a wilt, causing almost complete loss of crop, due to a species of *Verticillium* [see preceding abstract]; the Worldbeater and California Wonder varieties were affected on one farm, and an unknown variety in a different locality.

BAUDYŠ (E.). **Das plötzliche Absterben der Weinrebe.** [The sudden dying-off of the Vine.]—Reprinted from *Winzer, Brünn, 1937*, 7, 4 pp., 2 figs., 1937.

The author states that in Moravia, Czechoslovakia, sudden wilting and death (non-parasitic apoplexy) [*R.A.M.*, xiv, p. 347] of vinestocks has of recent years gradually become increasingly prevalent. Observations indicate that the chief factors inducing the condition are the progressive drying-up of the soil in the vineyards from year to year, and the excessive fluctuations between day and night temperatures that have occurred very frequently during winter and spring for several years in succession. Vineyards on soils containing excessive lime in the subsoil are particularly susceptible to the trouble, which may then be controlled by heavy applications of potassium and magnesium sulphates. On very acid soils, lime should not be applied alone but in a mixture with magnesium salts. Gypsum is also useful to correct excessive alkalinity of the soil.

BIRON (M.). **Les pulvérisations arsénicales contre le rabougrissement de la Vigne et contre divers parasites animaux et végétaux.** [Arsenical sprays for the control of Vine stunting and of various animal and plant parasites.]—*Rev. Vitic., Paris*, lxxxvii, 2268, pp. 458–461, 1937.

In this note the author states that recent experience has shown that two dormant sprayings of vines (immediately following pruning and just before the spring renewal of growth) with alkaline naptho-arsenite solutions [*R.A.M.*, xv, p. 555], besides affording excellent control of insect parasites of the vine, are also very effective in the control of certain fungal diseases such as 'esca' (*Stereum necator*) [ibid., xvi, p. 436], excoriosis (*Phoma flaccida*) [loc. cit.], and court-noué [ibid., xvii, p. 159].

Gabotto (L.). **La campagna peronosporica di quest' anno.** [The *Peronospora* campaign during the current year.]—*Boll. Lab. sper. R. Oss. Fitopat., Torino*, xiv, 1–4, pp. 44–45, 1937.

The author states that in 1937 the vines in Monferrato were invaded by six distinct waves of infection with downy mildew [*Plasmopara viticola*], of which the last in the second half of August was the only one that caused serious damage to the grapes, especially where the latter had failed to receive applications of cupric dusts. The results of the season again showed that Bordeaux mixture containing at least 1 per cent. copper sulphate, in combination with careful dusting of the developing grape bunches with dusts containing 20 per cent. copper sulphate, was more effective in the control of the disease than all the other preparations tested.

Du Plessis (S. J.). **Studies on the physiology and parasitism of Botrytis cinerea Pers.**—*Ann. appl. Biol.*, xxiv, 4, pp. 733–746, 2 pl., 1937.

A tabulated account is given of the author's culture studies on two of the varieties (B 1*c* and B 12*c*) of *Botrytis cinerea* discussed by him in a previous communication [*R.A.M.*, xv, p. 701]. No definite conclusion could be drawn as to whether these two varieties prefer nitrogen in the ammonium or in the nitrate form; the greatest weight of mycelium was produced per unit weight of nitrogen consumed from a nitrate source, although growth on such media was somewhat poorer; the amount of acid produced was greater on media containing nitrogen as nitrates than on those supplying it as ammonium compounds. There was clear evidence that the changes in acidity induced by the organisms in the media, and also the total amount of acid produced, depend upon the variety of *B. cinerea*, the source of nitrogen supplied, and the initial hydrogen-ion concentration of the medium. In a special series of tests it was shown that the susceptibility of uninjured Henab Turki grapes to the B 12*c* variety increased with maturity, and that injured berries were slightly susceptible even when they were green. A fair amount of growth of this variety occurred in raw sterilized juice from the greenest grapes tested. The experiments clearly demonstrated the important protective part played by the cuticle and cell walls of the grapes against invasion by *B. cinerea*.

Salmon (E. S.) & Ware (W. M.). **Department of Mycology.**—*J. S.-E. agric. Coll., Wye*, xli, pp. 15–19, 1938.

This report [cf. *R.A.M.*, xvi, p. 366] contains the following items of interest. Five out of 33 Ulster Monarch potato plants in one row at Wye were infected by *Botrytis cinerea* at ground-level. Broccoli was severely attacked by *Cylindrosporium concentricum* [ibid., xv, p. 474], which occurred on the laminae and petioles, causing withering and scorching of the outer leaves. Tomatoes were affected by *Verticillium* wilt [*V. albo-atrum* or *V. dahliae*: ibid., xv, p. 690] and fruit rot (*Phoma destructiva*) [ibid., xvi, p. 419]. The leaves of Bramley's Seedling and Worcester Pearmain apples showed numerous angular spots 1 to 2 mm. in diameter, greyish-brown on the upper, and brown on the lower, surface of the lamina, associated with a *Phyllosticta*. *Plasmopara viticola* occurred on a vine. Cultivated mushrooms [*Psalliota* spp.] were affected

by *Verticillium malthousei* [ibid., xv, p. 775]. Watercress beds in Sussex were reported to have become almost bare in large patches; the affected plants showed the presence of a *Pythium* which W. R. I. Cook considers will probably prove to be *P. megalacanthum* [ibid., xiv, p. 362]. *Septoria drummondii* was found on the dying leaves of blue-flowered *Phlox drummondii* plants. Hops when picked were virtually free from *Pseudoperonospora humuli* [ibid., xvi, p. 366]; cottonseed oil-Bordeaux emulsion with added nicotine was satisfactory as a combined fungicide-insecticide [ibid., xvi, pp. 818, 835].

Seed testing and plant registration.—*Scot. J. Agric.*, xxi, 1, pp. 54–70, 1938.

The following items occur in this report. In further investigations into strawberry red core [*Phytophthora* sp. allied to *P. cinnamomi*: *R.A.M.*, xvi, p. 515] in Scotland, 18 seedlings from various crosses tested in infected land in 15 different localities under commercial conditions appeared to remain immune for a number of years, and are now under test for their commercial qualities. Five of the seedlings are stated to show high promise.

Raspberry spur blight (*Didymella applanata*) [ibid., xvi, pp. 152, 298] was very disastrous in Perthshire in July, 1937, the attack on fruiting spurs and laterals proving particularly harmful. Infection was strongly favoured by drought in early summer followed by wet weather late in June.

In studies on potato virus diseases analyses of diseased plants for virus content gave the following provisional findings. Faint mottling is caused by a mild strain of virus X and sometimes by virus A; mild mosaic is normally caused by virus X; border-line severe mosaic by A+X, but may be due to infection by severe strains of X, by Y alone, or Y+mild strains of X; and severe mosaic by Y alone or in combination with other viruses. Observations made in different districts of Scotland showed that severe mosaic may increase by 100 to 150 per cent. and leaf roll by 200 to 300 per cent. in one year. Faint mottle caused a reduction in yield of up to 25 per cent., mild mosaic 40 per cent., border-line severe mosaic up to 64 per cent., severe mosaic 84 per cent., and leaf roll up to 96 per cent. (in Golden Wonder).

When potato tubers were dipped in six different chemical solutions after lifting, the greatest reduction in subsequent dry rot (*Fusarium coeruleum*) [ibid., xvi, p. 514] was given by 1 per cent. commercial formalin and a 1·66 per cent. solution of an organic mercury compound. Wounding increased the incidence of the disease, but after December this effect was less marked. Bruising also increased dry rot, but the effect depended on the type of potato variety affected, and its maturity.

Voelkel (H.) & Klemm (M.). **Die wichtigsten Krankheiten und Schädigungen an Kulturpflanzen im Jahre 1937. (Beobachtungs- und Meldedienst der Biologischen Reichsanstalt.)** [The most important diseases and injuries of cultivated plants in the year 1937. (Observation and warning service of the Reich Biological Institute.)] —*Beil. NachrBl. dtsch. PflSchDienst*, xviii, 1, 28 pp., 3 graphs, 66 maps, 1938.

This valuable survey of the diseases and other injuries affecting cultivated plants in Germany during 1937 has been prepared on similar lines to those of previous years [*R.A.M.*, xvi, p. 367].

Faes (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1936.** [Annual report for 1936 of the Federal Viticultural Experiment Station at Lausanne and Domaine de Pully.]—*Annu. agric. Suisse*, li, 10, pp. 1045–1079, 4 figs., 2 graphs, 1937.

The following are among the phytopathological items occurring in this report [cf. *R.A.M.*, xvi, p. 152]. *Coniothyrium diplodiella* [ibid., xvii, p. 95] was observed on the wood of American vine varieties serving as stocks, the symptoms on which were similar to those described by Istvanffy from Hungary.

One application of the so-called 'blue' treatment (6 per cent. Bordeaux mixture) to dormant Canada Pippin, Gravenstein, and Franc-Roseau apple trees shortly before coming into leaf gave better results than five or six of lime-sulphur (2 per cent.) plus 0·2 per cent. viricuivre against scab [*Venturia inaequalis*], the incidence of which on the three varieties was 19·7, 10·6, and 14 per cent., respectively, and 39·9, 47·8, and 42·7 per cent., respectively, for the two schedules, compared with 97, 90, and 71·4 per cent., respectively, for the unsprayed controls.

Apple mildew (*Podosphaera*) [*leucotricha*] appears to be definitely on the increase in Swiss orchards, where fairly satisfactory control has been obtained by spraying with 2 per cent. lime-sulphur before flowering.

The elimination of *Didymella applanata* [see above, p. 374] from raspberry plantings presents great difficulties. The incidence of infection was reduced from 33 to 14 per cent. by the application of 2 per cent. Bordeaux mixture on 20th November, 1935, followed by 0·5 per cent. Bordeaux mixture plus novemol on 18th May and 17th and 27th June, 1936, and to 12 per cent. by 2 per cent. Bordeaux mixture followed by three treatments with copper dust on the same dates.

Smith (F. E. V.). **Report of the Plant Pathologist.**—*Rep. Dep. Sci. & Agric. Jamaica, 1936*, pp. 47–55, 1937.

The land on which banana cultivation has been abandoned in Jamaica owing to Panama disease (*Fusarium oxysporum cubense*) amounted to 32,839 acres at the end of 1935, which confirms the earlier estimate [*R.A.M.*, xvi, p. 300]. Banana leaf spot disease due to *Cercospora musae* [ibid., xvii, p. 331] is reported to have caused more intense damage than in previous years. It has been identified in almost every parish of the island, but serious damage to the crop has occurred only on plants growing under conditions producing flushes of soft growth, as in the plains of St. Andrew, Western St. Catherine, and in Vere.

Bacterial bud rot of coco-nut has continued to cause serious losses in Montego Bay, Lucea area, where it is restricted to a coastal belt two or three miles deep.

Wastage in eggplant fruit after export, due to *Phomopsis vexans* [ibid., xvi, p. 296], was noticed in April, May, and June, 1936.

Spraying with shirlan has been tested as a measure of control against leaf mould of tomatoes [*Cladosporium fulvum*: ibid., xv, p. 74]. Two

plots of four-weeks-old Marglobe plants were sprayed with shirlan AG at a rate of $1\frac{1}{2}$ and 1 oz. per gal., respectively, the third plot being left unsprayed. After eight applications at weekly intervals the proportion of yields per plot was 5, 3, and 2, respectively. A concentration of $1\frac{1}{2}$ oz. per gal. appears to control the disease, but the cost of the treatment is excessive, since 180 gals. of spray per acre are required at each application.

SIMMONDS (J. H.). **Plant pathological investigations.**—*Rep. Dep. Agric. Qd, 1936–37*, pp. 82–84, 1937.

This report contains the following items of interest apart from those already noticed from other sources [*R.A.M.*, xvi, p. 155]. During the season under review leaf spot of tobacco (*Cercospora nicotianae*) [ibid., xvii, p. 212] was particularly prevalent. It was observed in many instances that crops produced from seedlings sprayed with colloidal copper showed less infection than those produced from seedlings treated with [benzol] vapour [loc. cit.]. It is suggested that the combined application of both methods during the wet periods may prove the most effective. A leaf spot of tobacco which caused some concern in south-western districts was attributed to *Phyllosticta nicotianae* and this diagnosis was confirmed by F. A. Wolf.

The efficacy of colloidal copper (1 gal. stock solution to 13 gals. water) in the control of brown spot of the Emperor mandarin [ibid., xvi, p. 451] was confirmed in a further spraying trial at Howard, conducted by F. W. Blackford. The average percentage of diseased fruit on trees sprayed in September, October, December, and late February was 3·1 compared with 31·1 in the controls. Trees sprayed in September, November, and late February yielded a slightly higher percentage of infection, but this shorter schedule is recommended as more practical.

Ascochyta caricae, *Gloeosporium* sp., and an undetermined fungus have been found causing the common ripe rot of papaw [cf. ibid., xv, p. 363]. The virus disease, yellow crinkle, was very prevalent in most districts in the early part of 1937 and caused considerable losses. An abnormal and rapid spread of the virus disease of passion fruit known as woodiness [ibid., xvi, p. 796] was observed during the year in spite of strict eradication and disinfection measures. Twig injections with zinc gave satisfactory results in preliminary investigations of the apple little leaf problem [ibid., xvi, p. 754].

J. E. C. Aberdeen records for the first time in Queensland the outbreak of bacterial canker (*Aplanobacter michiganense*) on tomato [ibid., xv, p. 280; xvii, p. 354].

On pp. 85–89 of the same annual report H. K. Lewcock sums up the results of pineapple investigations and states that on most Queensland soils iron deficiency resulting in serious metabolic disturbances and leading to dwarfing, susceptibility to disease, and chlorosis can be rectified by the use of sulphur. In the case of some soils, however, particularly highly buffered manganiferous soils, it is advisable for economic and other reasons to spray the foliage with a solution of sulphate of iron instead.

Division of Plant Pathology.—*Rep. N.Y. St. agric. Exp. Sta., 1936–37*, pp. 54–65, 1938.

This report of the Division of Plant Pathology (replacing the former Division of Botany) of the New York State Agricultural Experiment Station [cf. *R.A.M.*, xvi, p. 438] contains the following, among other, items of interest. The examination of 150 budded apple trees badly infected by crown gall [*Bacterium tumefaciens*: ibid., xvi, p. 191], set in 1934 and removed in 1936, showed that the condition of the top growth was approximately the same in all cases and did not reflect that of the roots. Fresh galls had formed on new roots during the three years the trees were in the ground, and the root system in many cases was very poor. The original galls were still present on a number of the trees, while others had decayed and permitted the entry of secondary organisms to the roots or trunk. It is concluded that either grafted or budded trees infected by crown gall should be placed in the cull class and discarded for planting purposes.

The Marcy and Indian Summer red raspberry varieties, originated by the Station, have remained absolutely free from mosaic infection following extremely severe intentional exposure to natural virus spread for four seasons in the Hudson Valley and for three in western New York, while several other unnamed seedlings of identical or similar parentage also escaped the disease completely in the trial plantings.

'June yellows' [see below, p. 402] of strawberries appears to be a variegation of genetic origin rather than an infectious virus disease. Certain stocks of the widely grown and highly susceptible Premier variety have remained free from the disorder even in close proximity to affected strains, and their use for planting material is recommended as an effective control measure.

Fusarium wilt of cantaloupes [ibid., xvii, p. 154] was experimentally shown to be transmissible by means of the seed from infected fruit.

Both yellow oxide of mercury and calomel [mercurous chloride], incorporated with the fertilizer mixture at the rate of 2, 4, or 6 lb. per acre, reduced the incidence of potato scab [*Actinomyces scabies*: ibid., xvii, pp. 199, 268], the intermediate quantity generally giving the best results. On certain soils, however, with a reaction of P_H 5·6 or above, infestation may be so severe as to preclude commercial control by this treatment.

A serious disease of hops, known as 'slip-down' and first recognized in 1935 but probably of at least 30 years' standing, is believed to be due to a virus. Affected plants seldom climb far up the poles and commonly slip down; in severe cases few or no cones are produced.

Notes are also given (on pp. 91–95) on fungi occurring on seed samples and on the effect of disinfectants on germination.

Report of progress for year ending June 30, 1937.—*Bull. Me agric. Exp. Sta.* 387, pp. 157–262, 6 figs., 4 graphs, 1937.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xv, p. 483]. A blend of Bordeaux mixture and linseed oil was found by M. T. Hilborn to be the most effective wound dressing for the protection of winter-injured apple trees [ibid., xvii, p. 327],

acting as a satisfactory disinfectant and adhering to the treated surface for two to three years.

In an experiment conducted by R. Bonde and L. A. Schaal, Irish Cobbler potato tubers selected for freedom from *Rhizoctonia* [*Corticium solani*] and treated with mercuric chloride yielded $175 \pm 2 \cdot 43$ barrels per acre compared with $171 \pm 3 \cdot 06$ from similarly treated, unselected seed, the comparable figures for sanoseed being $176 \pm 2 \cdot 93$ and $165 \pm 3 \cdot 51$, and for the untreated controls $179 \pm 3 \cdot 71$ and $149 \pm 3 \cdot 18$, respectively.

One of the most severe late blight [*Phytophthora infestans*: ibid., xvii, p. 267] epidemics in the history of Aroostook County occurred during the late and excessively wet season of 1936, and immense losses were obviated, according to R. Bonde, by a very intensive spraying programme. A comparison of different spraying schedules showed that the earlier applications could be omitted with safety provided that the best modern spraying equipment was used, and that basic copper sulphate was almost as efficient as Bordeaux mixture, but that copper-lime dusts compared unfavourably. During the climax of the disease in August, the foliage of Green Mountain was rapidly destroyed, and fully 50 per cent. of the tubers of this variety were found to be decayed, whereas those of a new seedling, # 44488, remained sound and the leaves were little affected. The yield of # 44488 amounted to $119 \pm 3 \cdot 33$ barrels per acre compared with only $67 \pm 5 \cdot 22$ from Green Mountain.

G. W. Simpson succeeded in one locality in raising Green Mountain potatoes for seed purposes entirely free from mild mosaic and leaf roll throughout the growing season (the fifth since the importation from Canada of the seed in question). Three factors are believed to be involved in the absence of disease from the plot in question, viz., its isolated position, offering little or no risk of extraneous infection; continuous roguing from the time the plants reached a height of 6 in. until maturity; and timely harvesting of sufficient seed for planting the following season. Little success is to be expected in inadequately isolated plots.

Botany.—*Rep. Pa agric. Exp. Sta., 1936–37* (*Bull.* 352), pp. 38–41, 1 fig., 1937.

In this report [cf. *R.A.M.*, xv, p. 138] J. W. Sinden states that many mushroom-growers use synthetic compost [ibid., xvi, p. 793; xvii, p. 11] mixed with an equal quantity of well-composted horse manure. Experiments showed that this did not reduce the crop, and mixture with one-quarter of horse manure reduced it only slightly. The addition of phosphorus in the form of bone meal or superphosphate had no effect on the yield, but under certain circumstances the addition of brewers' grains improved the compost. Single spore strains of mushrooms [*Psalliota* spp.] were found to vary widely in yield and quality, one-third of them yielding no crop at all. One strain seemed promising, but showed susceptibility to the 'open veil' symptom under dry conditions.

According to W. S. Beach the following injurious fungi in mushroom manure were killed at a fermentation temperature of 115° to 120° F.: *Mycogone perniciosa* [ibid., xvi, p. 653], *Verticillium* sp., *Dactylium* sp., *Monilia* [*Oospora*] *fimicola* [ibid., xvii, p. 92], *Trichoderma* spp., and *Bacterium* [*Pseudomonas*] *tolaasi* [ibid., xvii, p. 13]. *Myriococcum*

praecox [ibid., xvi, p. 653] was killed at 129° F. and *Chaetomium olivaceum* [ibid., xiv, p. 345] at 140°, while *Pseudobalsamia microspora* [ibid., xv, p. 138; xvii, p. 93] survived temperatures over 140°. The prevalence of *O. fimicola* depends on alkalinity after composting, but prolonged fermentation at 130° to 140° should enable the spawn to compete successfully with all moulds.

E. L. Nixon reports that further experiments confirm the resistance of the Richard Peters pear to fireblight [*Erwinia amylovora*: ibid., xv, p. 138; xvii, p. 48]. Crosses of Bosc on Richard Peters, which are now coming into bearing, seem to be equally resistant, and should be of better quality.

In control of tobacco wildfire [*Bacterium tabacum*: ibid., xv, p. 138; xvii, p. 354] the previously recommended measures have been found effective in field trials on 24 farms.

A year's progress in solving farm problems of Illinois.—*Rep. Ill. agric. Exp. Sta., 1935–36*, 333 pp., 34 figs., 1 diag., 15 graphs, 2 maps, 1937.

This report [cf. *R.A.M.*, xiii, p. 217] contains the following items of interest. According to B. Koehler and H. H. McKinney wheat mosaic [*R.A.M.*, x, p. 647], attacking winter varieties, is now known to cause more damage in Illinois than in any other part of the world. Under conditions favourable to the disease, crop losses amount to 80 per cent. Bald Rock, Fulcaster, Fulhio, Nabob, Shepherd, Trumbull, and Wabash are highly resistant varieties but none of them is satisfactory in all other desirable characters.

In the course of a comparative study on the control of loose and covered smuts of oats [*Ustilago avenae* and *U. kolleri*] directed by B. Koehler, seed grain of Iowar oats, the controls of which produced 6·3 per cent. smutty heads, was treated with ceresan at the rates of $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ oz. per bush. 67 days, 23 days, 1 day, and 10 minutes before sowing. The $\frac{1}{2}$ oz. treatment controlled the infection in all cases, the $\frac{1}{4}$ oz. treatment resulted in 0, 0, 0·42, and 0·49 per cent. smut, respectively, for the different periods of storage, and $\frac{1}{8}$ oz. gave 0·04, 0·25, 1·17, and 1·54 per cent. smut. Seed treatment with formalin at the rate of 1 pint to 50 bush. 67 and 23 days and 1 day before sowing resulted in 0, 0, and 0·08 per cent. smut, respectively; the corresponding percentages for 1 pint to 100 bush. being 0·08, 0·25, and 1·54, and for 1 pint to 150 bush., 1·13, 1·69, and 2·92.

Experiments carried out by H. W. Anderson proved that no parasitic fungus or bacterium can be held responsible for apple measles [see below, p. 400], a disease causing in some orchards a loss of 10 per cent. of the potential crop. It appears to be restricted to a few varieties, of which Red Delicious and its sports are the most susceptible. Grafting and budding experiments have so far failed to establish a virus origin of the disease.

Experiments conducted by S. C. Chandler to determine the minimum concentration of copper sulphate for effective spray control of peach leaf curl [*Taphrina deformans*: ibid., xvii, p. 255] indicate that it is unsafe to use less than 6 lb. of copper sulphate to 100 gals. of the spray. Trees sprayed with Bordeaux 8–8–100 and 6–6–100 showed 1

per cent. leaf curl, while trees sprayed with 4–4–100 showed 6 per cent., as compared with 24·5 per cent. in the controls.

H. W. Anderson and A. S. Colby have found three varieties of strawberries resistant to 'brown stele' disease [cf. below, p. 401], namely, Aberdeen (which is especially suited to conditions in Edgar county), Red Heart, and Mastodon.

The best results in controlling a stem rot disease of *Euphorbia fulgens*, caused by *Fusarium* sp., were obtained by F. F. Weinard and S. W. Hall by transferring cuttings directly into sterilized potting soil and then into steam-sterilized bench soil.

VINOGRADOVA (Mme O. S.) & PERSHINA-MANSIREVA (Mme S. G.). **Prophylactic action of the bacteriophage on the formation of the crown gall induced by B. tumefaciens.**—*Bull. Biol. Méd. exp. U.R.S.S.*, iv, 3, pp. 275–278, 2 figs., 1 graph, 1937.

Details are given of experiments conducted at the Moscow (U.S.S.R.) Microbiological Institute in 1935–6 on the preventive action of the bacteriophage of *B[acterium] tumefaciens* [*R.A.M.*, xvi, p. 369] on crown gall formation in beet [ibid., xvii, p. 285] and carrot plants, of which 1,107 were used during the two years' tests. On attaining a height of 6 to 10 cm., the seedlings were uprooted, rinsed with water, and immersed for 24 hours in a filtered solution of the bacteriophage. Inoculation was effected either by two hours' immersion of the roots in a suspension of the crown gall organism or through punctures. In another series of tests treatment with the bacteriophage followed immersion of the shoots in the bacterial suspension.

With a few exceptions, the bacteriophage treatment caused a marked decrease in the percentage of infected plants. To cite a few instances, in tests 3 and 4 (1935), the treatment produced 62 per cent. of healthy beet plants compared with 23 per cent. in the control series, while in 7 and 8, 59 per cent. of the treated carrot plants were healthy as against only 27 per cent. of the controls. In tests 7 and 8 of 1936 there were 82 per cent. sound carrots in the treated series compared with 10 per cent. in the controls.

SPRAGUE (R.). **Additions to the check list of the parasitic fungi on cereals and other grasses in Oregon (1935–37).**—*Plant Dis. Reptr*, xxi, 23, pp. 412–422, 1937. [Mimeographed.]

This further list of cereal and other grass pathogens found in Oregon is a continuation of the list published in 1935 [*R.A.M.*, xiv, p. 744].

SPRAGUE (R.). **Gill fungi associated with the roots of cereals.**—*Phytopathology*, xxviii, 1, pp. 78–79, 1 fig., 1938.

Pholiota dura, *P. praecox*, *Naucoria* spp., and a number of small, delicate, undetermined Agaricales have been found associated with oats, barley, and wheat crowns in western Oregon. The white, rhizomorphous mycelium of these fungi causes shredding and decay of necrotic and dead leaf sheaths and sometimes even appears to enter the outer cortical root cells. The introduction into greenhouse soil from 1930 to 1933 of a Basidiomycetous mycelium isolated in pure culture from wheat

and barley plants, far from adversely affecting the wheat, oats, barley, rye, and einkorn plants growing therein, actually stimulated their development. In 1934 similar inoculations were carried out with *P. dura*, which also exerted a mildly beneficial effect on the plants.

Barmenkoff (A. S.) & Pantchenko (N. P.). Микрокамера для оценки зерновых культур на устойчивость к ржавчине и проверка ее на селекционном материале. [A micro-chamber for testing the resistance of cereals to rust and for checking the reaction of breeding material.]—*Pl. Prot., Leningr., 1937*, 14, pp. 73–79, 1937.

Further details are given of the micro-chamber constructed by the first-named author for testing the varietal resistance of wheat to different races of *Puccinia triticina* [*R.A.M.*, xv, p. 636]. The apparatus, which should preferably be made of acetyl-cellulose, has been extensively tested with most satisfactory results.

Stakman (E. C.) & Cassell (R. C.). **The increase and importance of race 56 of Puccinia graminis tritici.**—Abs. in *Phytopathology*, xxviii, 1, p. 20, 1938.

Attention is drawn to the remarkable extension in geographical distribution and increase in prevalence of race 56 of *Puccinia graminis tritici* [*R.A.M.*, xiv, p. 350]. First observed in 1928, only in Iowa, Kansas, and Nebraska, it is now generally distributed on wheat throughout the United States, northern Mexico, and Canada (according to Dominion Rust Research Laboratory reports). From 1928 to 1931, inclusive, race 56 constituted 1 per cent. or less of the uredinial isolates identified by the writers in the United States: since then the following percentages have been recorded: 1932, 2·1; 1933, 3·7; 1934, 33·1; 1935, 44; 1936, 47; and 1937 (to 1st November), 56. Evidence is forthcoming that race 56 originated on barberry and was largely responsible for the collapse of Ceres wheat, which was moderately to highly resistant to stem [black] rust before 1935. In 1937, race 56 constituted some 70 per cent. of the Ceres isolates. The continued importance of the aecidial stage in the origin and persistence of races is shown by the fact that, from 1935 to 1937, inclusive, a different race was identified in every 6·5 aecidial isolates, the corresponding ratio for the uredinial stage being 1 : 59.

Vogel (O. A.) & Holton (C. S.). **Reaction of F_3 progenies of an Oro×Turkey-Florence cross to two physiologic races of Tilletia tritici and one of T. levis.**—*J. Amer. Soc. Agron.*, xxx, 1, pp. 55–59, 1938.

The reaction of the F_3 progenies of the cross Oro×Turkey-Florence wheat to two races of *Tilletia tritici* [*T. caries*] and one of *T. levis* [*T. foetens*: *R.A.M.*, xvii, p. 164] was studied at the Washington (State) Agricultural Experiment Station in 1936, and the results are fully tabulated and briefly discussed. Oro is susceptible to *T. foetens* race L-8, Turkey-Florence to *T. caries* T-11, and both slightly so to *T. caries* T-8.

The factors for resistance to all three bunt races have apparently been combined in some progenies and those for susceptibility in others.

Less than 5 per cent. infection occurred in 8 out of 190 F_3 offspring following inoculation with L-8, in 33 out of 188 inoculated with T-11, and in 33 out of 168 inoculated with T-8, while 4 out of 168 F_3 families averaged less than 5 per cent. for the three races. Selections from progeny 1098 continued to show high resistance in the F_4, and in 1937 further selections from these remained free from infection by 18 individual races of bunt and produced 3 to 23 per cent. partially bunted heads in response to infection by L-8.

RADULESCU (E.). **Uebt die Weizensorte eine selektive Wirkung auf Tilletia-Arten aus?** [Does the Wheat variety exert a selective action on *Tilletia* spp.?]—*Z. PflKrankh.*, xlviii, 1, pp. 39–42, 1 diag., 1938.

Preliminary experiments were undertaken from 1933 to 1936 at the Cluj (Rumania) Plant Breeding Station to determine the possible influence of the particular wheat varieties at present under cultivation on the distribution of *Tilletia tritici* [*T. caries*] and *T. foetens*, of which the former, once comparatively sparsely represented in south-eastern Europe, has lately been shown to predominate in the north and west of the country [*R.A.M.*, xiv, p. 502]. Six varieties (Cenad 117, Minturki C.J. 6155, Hâtif inversable, Turkey C.J. 1558, Strube's Dickkopf, and Berkeley Rock) were inoculated with five separate mixtures, in varying proportions, of the two smuts. During the period covered by the tests, the ratio of *T. caries* to *T. foetens* increased rapidly from year to year on five of the varieties; for instance, in mixture 3 (52·7 per cent. of the former and 47·3 per cent. of the latter) on Berkeley Rock, *T. caries* alone was detected in 1935, the same stage being reached by Cenad 117 and Minturki a year later, when Turkey was the only variety to show a slight admixture of infection by *T. foetens* (4·5 per cent.). Hâtif inversable constituted an exception to the rule, raising and lowering the ratio of *T. caries* to *T. foetens* in the different mixtures so as to equalize the proportions of the two smuts.

SKVORTZOFF (S. S.). Простой метод обнаружения гиф пыльной головни в зерне Пшеницы. [A simple method for detecting hyphae of loose smut in Wheat grains.]—*Pl. Prot., Leningr., 1937*, 15, pp. 90–91, 1937.

The author devised the following method for the detection of mycelium of *Ustilago tritici* in wheat grains. The embryos are separated from the grains, macerated in sodium hydroxide, stained with aniline blue, and examined under the microscope, where the hyphae appear distinctly blue among the almost colourless cells of the embryo.

PETIT (A.). **Traitements rapides des semences de Blé tendre contre le charbon interne (Ustilago tritici).** [Rapid treatments of soft Wheat seed-grain against loose smut (*Ustilago tritici*).]—*Bull. Direct. Aff. écon.; Tunis*, 2, 22 pp., 1 graph, 1937.

In this paper the author discusses the technical and theoretical aspects of the control of loose smut (*Ustilago tritici*) of wheat in Tunis by the single and double bath hot-water treatments, the practical

information relating to which has already been noticed from another source [*R.A.M.*, xvii, p. 21].

LUTHRA (J. C.), SATTAR (A.), & GHANI (M. A.). **Perpetuation and control of Septoria disease of Wheat in the Punjab.**—*Agric. Live-Stk India*, viii, 1, pp. 17–25, 1938.

A study [the results of which are tabulated] on the manner of perpetuation, spread, and control of *Septoria tritici*, which causes a serious disease of wheat in the Punjab [*R.A.M.*, xvi, p. 733], showed that the pycnospores remain viable in the pycnidia borne on straw used for making 'bhusa' stacks [consisting of wheat straw broken into small pieces] and on diseased leaves left lying on the ground, as well as on diseased straw used in enclosing the stacks, and produce infection in the summer in the subsequent wheat crop. The fungus was found not to survive on infected debris buried in the soil at a depth of $1\frac{1}{2}$ in. or more. Control consists in suppressing these sources of infection, and should include the careful weeding of the edges of the fields. Field and pot inoculation tests with all the available types of wheat grown in the Punjab showed that the *Triticum durum* types are almost immune, while *T. compactum* and *T. vulgare* are susceptible.

VIK (K.). **Melduggresistens hos Vårhvete.** [Mildew resistance in spring Wheat.]—*Meld. Norg. LandbrHøisk.*, xvii, 7, pp. 435–495, 1937.

During the last 20 years spring wheat at the experimental farm of the Royal Agricultural College of Norway has been repeatedly attacked by mildew (*Erysiphe graminis tritici*) [*R.A.M.*, xvi, p. 801], which has also occurred in other parts of the country, sometimes in epidemic form, and is believed to have caused a heavier reduction in yield than any other fungal disease of the crop. All the commonly cultivated spring and winter wheat varieties have proved more or less susceptible to mildew, but a high degree of resistance has been shown by a single pure line isolated from an indigenous 'land' variety in 1919 (JO3) and an unnamed, late-ripening Japanese variety. Neither of these being suitable for extended cultivation, they have been kept for breeding purposes and used as one of the parents in some 50 crosses made with a view to combining mildew resistance with other desirable agricultural and commercial qualities.

In the F_1 generation resistance proved to be incompletely dominant, and in later generations segregation occurred in a variable manner, possibly owing to the presence of genetic factors for miscellaneous plant characters modifying the expression of the main resistance factor. The mean yield depression in twelve series of progeny from crosses between resistant and susceptible varieties was found to be 7·7 per cent. for grain and 7·2 per cent. for straw per unit of degree of attack according to a scale ranging from 0 (no infection) to 10 (leaves almost covered with mildew). Susceptible varieties often being infected to the degrees of 4 to 6 or above, the yield reduction may amount to 30 or 40 per cent. Many of the resistant lines obtained by hybridization have been tested on the experimental farm and found to outyield not only the susceptible varieties, but also their own resistant parents. The mean grain yields of two of these lines, O76–13 and O76–63, derived from a cross between

J03 and Mo07 (a non-resistant compactum type) are 26 and 21 per cent., respectively, above that of the most prolific susceptible variety, Ås. Similar results have been obtained in numerous trials on farms in the south-east of Norway. Line 076–13 is now available for distribution under the name of Fram.

GORLENKO (M. V.). **Resistance of winter Wheats to black bacteriosis (Bacterium translucens var. undulosum S.J.R.).**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xviii, 2, pp. 97–99, 1938.

In this paper data are given on the susceptibility of winter wheat races to black bacteriosis (black chaff), due to *Bacterium translucens* var. *undulosum* [*R.A.M.*, xvi, p. 243], a disease which generally affects the ears, leaves, and stalks, but in the U.S.S.R. is chiefly concentrated in the ears.

Field observations on 318 varieties of winter wheats grown on plots at the Kamenno-Stepnaya experiment station yielded the following results. The races *alborubrum*, *milturum*, and *ferrugineum* were very susceptible, the races *erythrospermum* and *lutescens* occupied an intermediate position, and the races *velutinum*, *hostianum*, *nigro-aristatum*, *barbarossa*, and *albidum* were resistant to the disease. The fact that red-eared races were more severely attacked seems to indicate that the chemical composition of their sap or of the pigment itself may exert some influence on the organism.

BRIGGS (F. N.). **The inheritance of resistance to mildew.**—*Amer. Nat.*, lxxii, 738, pp. 34–41, 1 graph, 1938.

A study was made at the California College of Agriculture from 1935 to 1937 of the inheritance of resistance to form 3 of barley mildew (*Erysiphe graminis hordei*) [*R.A.M.*, xvii, p. 307] in hybrids between the resistant varieties Arlington Awnless, Chinerme (C.I. 1079, Black Awnless, from Chungking, China), and Nigrate (a selection of Chinerme), and the susceptible Atlas, Hanna, and Goldfoil. The three resistant varieties were found to differ from the susceptible Atlas in the possession of two independent major factors for mildew resistance. Susceptibility to mildew was recessive in the F_1 and F_2 generations.

Crosses of the three resistant varieties with Hanna and Goldfoil resulted in the segregation of susceptible lines, indicating that the factor common to the two susceptible races is not carried by Arlington Awnless, Chinerme, and Nigrate.

Crosses of Chinerme and Nigrate with Arlington Awnless, and of Nigrate with Chinerme, produced no susceptible plants, showing that these varieties have at least one factor in common for mildew resistance.

HO (W. C.) & MELHUS (I. E.). **Pythium graminicolum on Barley in Iowa.**—Abs. in *Phytopathology*, xxviii, 1, p. 9, 1938.

Pythium graminicolum [*R.A.M.*, xvi, pp. 174, 562] was isolated in May 1936 from the roots of stunted, yellow, sometimes flaccid and dying barley plants in central Iowa, and shown to be the causal organism of the disease. Cross-inoculation experiments demonstrated the active parasitism of the fungus on timothy [*Phleum pratense*], millet [? *Panicum miliaceum*], wheat, rye, and maize, oats and sorghum

being much more resistant. *Pythium graminicolum* grew better in steamed alkaline than in acid soil (P_H 4 to 11). The hyphae were observed to penetrate the root tips in the zone just behind the cap, moving inter- and intracellularly. Reproductive organs developed profusely in the parenchymatous tissue and vascular bundles of the young infected roots. Seedlings grown in association with the pathogen in glass cylinders partly filled with steamed soil developed extensive root necrosis and aerial stunting.

Van Itallie (T. B.). **Magnesiummangel und Ionenverhältnisse in Getreidepflanzen.** [Magnesium deficiency and ionic ratios in cereal plants.]—*Bodenk. u. PflErnähr.*, N.F., v, 5-6, pp. 303–334, 3 graphs, 1937.

A comprehensive, tabulated account is given of the writer's theoretical and practical studies at the State Agricultural Experiment Station, Groningen, Holland, on the etiology and control of the Hooghalen or magnesium deficiency ['soil acidity'] disease of oats and other cereals [*R.A.M.*, ix, p. 16; xv, p. 461; and next abstract]. The symptoms were most conspicuous in soils of low base saturation and hydrogen-ion concentration. The magnesium content of the plants was low in limed soils, higher in soils receiving magnesium, and reached a maximum when calcium oxide and magnesium were applied simultaneously. The beneficial effect of calcium oxide was found not to be related to the hydrogen-ion content of the soil. The differences between the magnesium contents of normal plants and those showing deficiency symptoms were frequently small. When calcium oxide plus magnesium was applied to magnesium-deficient soils, the amount of magnesium necessary to correct deficiency symptoms in plants diminished with increased dressings of calcium oxide. On soils with a low hydrogen-ion concentration receiving ammonium sulphate, neither liming nor magnesium treatment completely eliminated deficiency symptoms or produced maximum yields. Mottling due to magnesium deficiency was more marked under the influence of ammonium sulphate than of sodium nitrate. The application of potash fertilizers to the soil decreased the calcium and magnesium contents of the plants and accentuated deficiency symptoms. The simultaneous application of potash and magnesium, however, produced the reverse effect. The intake of magnesium by the plants was found to depend both on the absolute supply of the element and on the ratio of the magnesium ion to others present.

Stieltjes (D.). **Eenige waarnemingen over de Hooghalensche ziekte en de ontginningsziekte op het mineralenproefveld op de 'De Eese' bij Steenwijk.** [Some observations on the Hooghalen and reclamation diseases on the mineral experimental field at De Eese near Steenwijk.]—*Landbouwk. Tijdschr., Wageningen,* xlix, 605, pp. 844–853, 1937. [English summary.]

The preference of Dutch farmers for the old-fashioned brands of kainit over the modern potash fertilizers now on the market is attributed by the writer, on the grounds of his observations and experiments near Steenwijk, to the magnesium content of the former which counteracts the tendency to the so-called Hooghalen or 'acidity' disease in

oats and other crops [see preceding abstract]. In a trial field on reclaimed land (P_H 4·2) on which white oats were the first crop to be cultivated, magnesium sulphate was the only one of various compounds used giving complete protection against this disorder, characterized by 'tigering' and distortion of the leaves and stunting of growth. A low hydrogen-ion concentration does not by itself induce such abnormalities, but it tends to disturb the magnesium metabolism of the plants, and the assimilation of the mineral is further impeded by the incorporation of lime with the soil. On the reclaimed land in the experimental field the condition is probably controllable by applications of magnesium sulphate at the rate of 80 kg. per hect.

Reclamation disease of oats [ibid., xvii, p. 236 and next abstract], characterized by a white, papery texture of the leaf tips, and by loose, white glumes, may develop long before the symptoms are usually recognized, namely, when the plant has produced only two or three leaves, which turn reddish-brown to greyish-white and finally shrivel. Other features of this disorder, the result of copper deficiency and remediable by the application of copper sulphate (100 kg. per hect.), include under-development, brown discoloration, and unravelling of the glumes, usually ascribed to *Thrips* and *Chlorops* infestation.

Arnd (T.) & Hoffmann (W.). **Spurenelemente und ihre Wirkung auf das Pflanzenwachstum unter besonderer Berücksichtigung von Versuchsergebnissen mit Kupfer.** [Trace elements and their effect on plant growth with particular reference to experimental results with copper].—*J. Landw.*, cxxix, 1–2, pp. 71–99, 1 fig., 1 graph, 1937.

In addition to a comprehensive review of the literature dealing with the role of various accessory elements in maintaining the health of agricultural crops, the writers describe, tabulate, and discuss the results of pot experiments at the Prussian Moorland Experiment Station, Bremen, in which the reclamation disease of Lischow oats [see preceding abstract] was successfully combated by the incorporation with the sandy heath soil of copper sulphate at the rate of 0·5 mg. per l. water. Even in soils with a plentiful moisture content the disorder developed among plants receiving water twice distilled over glass and virtually devoid of copper, whereas the copper content of ordinary distilled water (about 70 γ per l.) sufficed to prevent reclamation disease and that of tap water (40 γ) to reduce its severity. These data, taken in conjunction with the fact that the trouble may be remedied by painting the leaves with copper sulphate, are considered definitely to point to a deficiency of available or active copper in the soil as the cause of reclamation disease.

The paper concludes with a brief theoretical discussion of future possibilities in the use of other representatives of the 92 elements of the periodic system in the service of agriculture.

Storey (H. H.). **Investigations of the mechanism of the transmission of plant viruses by insect vectors. II.**—Abs. in *Proc. roy. Soc.*, Ser. B., cxxv, 838, pp. 25–26, 1938.

Continuing his investigations into the mechanism of the insect transmission of plant viruses [*R.A.M.*, xii, p. 686; xvii, p. 160] the author

found that individual insects of *Cicadulina mbila*, all of which were capable of acting as vectors of maize streak, varied greatly in their ability to cause infection during a short period of contact with the plant. The results obtained by comparing the infections brought about by the insects singly and in groups appeared to conform with the hypothesis that the effect of one insect is independent of those of any other insects that may cause punctures. If this is so, the plants used showed definite variation in susceptibility.

When the portion of leaf exposed to the insect was removed after contact, the probability of infection was reduced, and it was concluded that the virus had normally become established in the plant and had moved down a distance of some millimetres during contact.

While resting on a maize leaf *C. mbila* always has its mouth-parts inserted, though it may change its position and may suck intermittently. The stylets penetrate all the tissues, but are moved frequently until the phloem is entered. The insect can take up virus from the chlorotic part of a diseased leaf during a puncture lasting only 15 seconds and not passing beyond the mesophyll. Punctures confined to the green parts between the chlorotic areas fail to take up any virus, whether they extend to the mesophyll or the phloem. A single puncture can cause infection. The traces of all single infective punctures examined entered the phloem, those of unsuccessful punctures sometimes entering the phloem, and occasionally finishing elsewhere. Successful transmission took place through a wax membrane into a leaf below it providing it was not thick enough to prevent the stylets from reaching the phloem. Seedlings were not infected by insects feeding on the coleoptile, in which the phloem is beyond the reach of the stylets.

No plants became infected by any number of punctures if they were all of less than about 5 minutes' duration at temperatures ranging from 23° to 26° C. Many punctures of less duration reached the phloem.

The hypothesis is advanced that inoculation occurs in distinct doses, each independent in its effect of other doses inoculated by the same or other insects. The delivery of a dose is determined by some incident occurring only after the puncture has been maintained for some time.

PERLET (J.). **Zur Bekämpfung des Mais-Beulenbrandes.** [On the control of Maize smut.]—*Dtsch. landw. Pr.*, lxv, 1, pp. 7–8; 2, p. 16, 1938.

Some practical suggestions are made for the control of maize smut [*Ustilago zeae*: *R.A.M.*, xvii, p. 237] in Czechoslovakia. Beginning at the end of June or early in July, the fields should be regularly inspected once a week and diseased plants removed, preferably by cutting, and burnt, the soil round the base being treated with 4 to 5 per cent. copper sulphate to destroy any fallen spores. At least six or eight years should be allowed to elapse between one maize crop and the next. Many farmers are of the opinion that smutted maize may safely be fed to livestock after silage, but this view is not shared by the writer. According to recent experiments, 36·81 per cent. of the spores were still viable after thorough silage, a larger number, in fact, than were found capable of germination (21·15 per cent.) in incompletely fermented maize, which contains a high proportion of butyric acid. It is therefore

concluded that diseased fodder is not only unwholesome, but that its consumption may well entail the perpetuation and extension of the disease.

WELLHAUSEN (E. J.). **Genetics of resistance to bacterial wilt in Maize.** —*Res. Bull. Ia agric. Exp. Sta.* 224, 114 pp., 7 figs., 42 graphs, 1937.

In studies [which are fully described] made to determine the mode of inheritance in maize of resistance to bacterial wilt (*Phytomonas* [*Aplanobacter*] *stewarti*) [*R.A.M.*, xvii, p. 238], particularly in the later generation progenies of two crosses of OSF, a very resistant inbred dent maize, with WF, a very susceptible inbred flint maize, and with W-134, a very susceptible inbred early yellow sweet maize, resistance was found to be almost completely dominant in the F_1 generation. The back-cross progeny ($F_1 \times$ susceptible) of both crosses fell into four equal groups, very resistant, moderately resistant, susceptible, and very susceptible. These differences were attributed to the independent segregation of supplementary factors for resistance: Sw_1 and Sw_2, which are completely dominant over their recessive alleles, sw_1 and sw_2, respectively.

In certain back-cross tests under different environmental conditions each group could be subdivided into two further groups, one slightly more resistant than the other, indicating the presence of a third, minor supplementary factor Sw_3. According to the data, this factor, when alone, produces a degree of resistance only slightly higher than that shown by the triple recessive types, and when in combination with Sw_1, Sw_2, or both, modifies their expression by slightly increasing resistance. The results of F_2 tests and tests of F_3 and back-cross families confirmed this factorial hypothesis.

It was demonstrated that the parental combinations red cob colour and resistance, and white cob colour and susceptibility were more frequent in the back-cross and F_2 progeny than the non-parental combinations, indicating that one of the factors for resistance is genetically linked with the P-gene for cob colour; but the frequency of the non-parental types in the later generations indicates that the linkage is not very close.

The parental combinations late maturity and resistance, and early maturity and susceptibility tended to remain together in the later generation progenies. Endosperm characters appeared to segregate independently of resistance.

WEIMER (J. L.), BURTON (G. W.), & HIGGINS (B. B.). **Ascochyta sorghina Sacc. on Sudan Grass, Johnson Grass, and Sorghums in Georgia.**—*Plant Dis. Reptr*, xxi, 21, p. 378, 1937. [Mimeographed.]

Ascochyta sorghina [*R.A.M.*, xvii, p. 105] was observed in Georgia in 1936 on Leoti sorghum and Sudan grass [*Sorghum sudanense*], and in 1937 on Grohoma and Shallu grain sorghums, Goose-neck sorghum, Sudan grass, and Sudan×Leoti sorghum hybrids. The disease was also found in the same state on Early Amber and Orange sorghums and Johnson grass [*S. halepense*]. It appeared in experimental plots and commercial plantings, and was stated by one grower to have been present for 40 years. The fungus appears to be a vigorous parasite.

Parker (E. R.). **Effect of zinc applications on the crop of Grapefruit trees affected with mottle-leaf.**—*Hilgardia*, xi, 2, pp. 35–53, 3 figs., 7 graphs, 1937.

The nature of the damage and the losses caused in grapefruit orchards by mottle leaf are fully described and illustrated. Treatment of grapefruit trees at the beginning of the blooming period with sprays consisting of 10 lb. zinc sulphate, 5 lb. hydrated lime, and 4 oz. powdered blood-albumin spreader in 100 galls. water [*R.A.M.*, xvii, p. 312] is reported to increase the total yield from badly affected trees by several hundred per cent., and to produce a striking improvement in size, shape, thickness of rind, and juice content of the fruits. Treated trees appeared to suffer no injury from hydrocyanic acid fumigations, which severely marked the fruit from untreated trees.

Jenkins (Anna E.). **Elsinoe on Lemon fruits from Paraguay.**—*Phytopathology*, xxviii, 1, pp. 73–75, 1 fig., 1938.

The conidial (*Sphaceloma*) stage of *Elsinoe australis*, the agent of sweet orange scab [*R.A.M.*, xvi, p. 603], was recently detected in New York on two consignments of lemons imported from Paraguay. The diseased fruits were severely disfigured by burnt-sienna-coloured lesions. The fungus has not hitherto been observed in the United States, so that its appearance on fruit exposed for sale in the market constitutes a serious threat to the citrus industry. *S. australis* was isolated and cultured from the imported lemons and its viability thereby demonstrated.

Brooks (C.) & McColloch (L. P.). **Some effects of storage conditions on certain diseases of Lemons.**—*J. agric. Res.*, lv, 11, pp. 795–809, 3 figs., 9 graphs, 1937 (issued February, 1938).

A tabulated account is given of experiments from 1933 to 1936, inclusive, in which lemons of varying degrees of maturity, imported from Los Angeles, California, were stored at the Arlington Experiment Farm, Virginia, at five temperatures ranging from 32° to 60° F. The results showed that during the first six or eight weeks of storage more decay from fungal rots developed at the higher than at the lower temperatures, this being especially true of *Alternaria citri* [*R.A.M.*, xvi, p. 744; xvii, p. 310] rot, which is stated to have been the most common and was not controlled by carbon dioxide [ibid., xvi, p. 44; xvii, p. 312]; with longer periods of storage the amount of decay was sometimes greater at the lower than at the higher temperatures, apparently owing to the development of pitting and a watery breakdown similar to that in the grapefruit [ibid., xvii, pp. 189, 312]. Pitting was particularly bad at temperatures below 40°, but seldom serious at 50°, and did not occur at 60°; storage for one or two weeks at the lower temperatures before transference to the higher temperatures did not, however, increase pitting, while pre-storage treatments with high concentrations of carbon dioxide and waxing the lemons tended to decrease it. Membranous stain (or membranosis), characterized by a browning or darkening of the carpellary walls between the segments, sometimes extending to the central core and to the inner cortical tissues, developed most abundantly (75 to 100 per cent.) at 40°, while at 32°, 50°, and 60° its occurrence

was in the order of 1, 8, and 2 per cent., respectively; storing the lemons for one or two weeks at 32° before transferring them to 50° or 60° usually tended to reduce the percentage of stain developing at the two higher temperatures, but fruit held for one or two weeks at 40° before transference sometimes developed more. Waxing the lemons and storage in carbon dioxide atmospheres usually tended to decrease membranous stain. Scald and red blotch were occasionally found on fruit held at low temperatures. Pre-storage treatment with high concentrations of carbon dioxide tended to delay colour development in the immature fruit, but no other injury resulted from the treatment, or from the accumulation of low percentages of the gas in the storage atmosphere. Waxed fruit lost weight and firmness very much more slowly than unwaxed.

KLOTZ (L. J.) & BASINGER (A. J.). **Water spot of Navel Oranges.**—*Calif. Citrogr.*, xxiii, 3, p. 115, 1938.

The disease of citrus known as 'water spot' in California [*R.A.M.*, xiv, p. 548] is a non-parasitic breakdown of the rind due principally to the imbibition of external water by the albedo. Invasion of the affected part by decay-producing fungi, chiefly blue and green moulds [*Penicillium italicum* and *P. digitatum*, respectively] causes the rapid decline known as 'water rot'. Under local conditions the trouble is important only on Navel oranges maturing during the rainy season, towards the end of which several days of continuously wet weather are enough to cause serious losses. Oranges with large open convolutions and growth cracks, fruit in an advanced stage of maturity, and varieties with weak rinds, such as the Thompson Navel orange, are very susceptible, while fresh wounds in the rind are important factors in increasing incidence. A preliminary test indicated that losses may be reduced by means of a protective spray of paraffin wax emulsion, while other important methods consist in early picking, orchard heating, the use of windbreaks, and the careful avoidance of injury.

BAIN (F. M.). **Bronze leaf wilt disease of the Coconut Palm.**—48 pp., 8 pl., 4 figs., 5 graphs, 2 maps, Trinidad, Government Printing Office, 1937.

A detailed account is given of an exhaustive study carried out by the author in Trinidad of coco-nut bronze leaf wilt [*R.A.M.*, xiv, p. 579] and its control with particular reference to the influence of soil factors. The main cause of the disease is water deficiency in the plant; in some instances unbalanced nutrition, for which potash fertilizers serve as a remedy, may be a contributing factor.

The disease occurs on three classes of soil; (1) where the surface is of a close texture and overlies a subsoil impervious to water, with the result that waterlogging is common in wet periods, and the surface soil dries out rapidly in dry ones, (2) (*a*) where the soil and subsoil are of open texture and drain freely, with the result that in dry weather the water supply is poor, (*b*) where the soil and subsoil are compact and dry out rapidly in drought periods, and (3) where the top soil is friable, and the subsoil layer intolerant. Preventive measures in soils of the first class consist in deep draining and banking of beds, trenching, and

liming; in soils of the second class in irrigation, trenching and mulching, potash applications, and wider planting; in the third, no preventive measures are possible, and another crop should be substituted. It is pointed out that bronze leaf wilt symptoms result when air is cut off from the roots, and that spread of the disease in the direction of the wind may be explained from a consideration of the effect on transpiration.

Из работ станции защиты растений всесоюзного н.-и. хлопкового института. [Abstract of the investigations of the Plant Protection Station of the Pan-Soviet Institute for Scientific Research on Cotton.]—*Pl. Prot., Leningr., 1937*, 15, pp. 99–112, 1937.

This is a collection of papers by various authors on the control of blackarm [*Bacterium malvacearum*: *R.A.M.*, xvi, p. 171] of cotton. According to D. D. Verderevsky a comparison of seed disinfection methods proved that of nine different disinfectants formalin (1 : 100) was the most effective. In a further paper the same author states that experiments on the artificial infection of cotton with *Bact. malvacearum* have shown the following varieties to be absolutely immune from the disease: 02129 from Turkey, 5946 and 9331 from South India, 02289–1 from Manchuria, and 2869 from Mozar-y-Sheriff [ibid., xiv, p. 304]. All these belong to the 26-chromosome group, whereas the species usually grown in the U.S.S.R., such as *Gossypium hirsutum* and *G. barbadense*, belong to the 52–chromosome group. Recent investigations seem to indicate the possibility of breeding immune hybrids between these two groups.

In a paper on hot-water treatment of cotton seed as a measure of control against *Bact. malvacearum*, D. D. Verderevsky describes experiments in which seed was heated for one hour in hot water at temperatures ranging from 50° to 57° C.: it was found that at 56° to 57° C. almost complete sterilization was achieved. The author suggests that further studies in this direction would probably lead to the discovery of a most effective method of treatment against both internal and external seed infection.

Mme N. P. Lebedeva reports investigations on the bacteriophage of *Bact. malvacearum* [ibid., x, p. 662], in the course of which its presence was established in cotyledons, leaves, stems, and bolls of herbarium specimens and living diseased cotton plants. It was also found in the water of ponds near cotton plantations and the river Lybed near Kiev. The presence of the bacteriophage in the soil remains doubtful pending further experiments. Various tests showed that a temperature of 56° to 59° C. is lethal to the bacteriophage only after 60 mins.' exposure, whereas *Bact. malvacearum* is killed after 10 mins.' exposure at 54° to 56° C. The lysis is most effective for all strains of the bacterium at a temperature of 20° to 37° C. Experiments showed that three months' desiccation did not destroy the bacteriophage. The influence of sunlight was ineffective up to two hours, but after three hours' exposure either the lysis was lessened or the bacteriophage destroyed. It was possible to select three bacteriophages out of seven examined, which were lytic to all of the 25 original strains of *Bact. malvacearum* tested. Field experiments in 1936 in Tashkent showed that bacteriophage

treatment of cotton seeds in combination with vernalization lowered the infection by 74 per cent. in comparison with the control, but treatment of the seeds undertaken shortly before sowing showed very little effect.

SABOUROVA (Mme P. V.). Физиологическое изучение трахеомикозного увядания Хлопчатника. [Physiological study of the tracheomycotic wilt of Cotton.]—*Pl. Prot., Leningr., 1937*, 15, pp. 61–68, 1 graph, 1937. [English summary.]

Hothouse experiments with upland cotton No. 169, artificially infected with *Verticillium dahliae* [*R.A.M.*, xvii, p. 240] showed that transpiration was lowered by 30 to 40 per cent. in plants infected in the basal part of the stem and by 15 to 20 per cent. in plants infected at the base of the primordial leaf. The osmotic pressure in the leaves was also lowered by between 2 and 3 atmospheres. Planting in closer stands affording denser shade is recommended as a measure of control.

MOSKOVETZ (S. N.). Курчавость листьев Хлопчатника в Азербайджанской С.С.Р. [Cotton leaf curl in Azerbaidjan.]—*Pl. Prot., Leningr., 1937*, 14, pp. 102–103, 1937.

Leaf curl disease of cotton [*R.A.M.*, xvi, p. 48] was first observed in Azerbaidjan in 1934, when 1 to 2 per cent. of the crop was diseased (20 per cent. in a few districts), the Egyptian varieties being mainly affected. In 1935 the incidence of infection amounted to 7·8 and 10·2 per cent. on the Egyptian strains Fuadi and Maarad, respectively, and to 0·5 to 1 per cent. on the upland varieties, and increased still further in the following year. The decrease in yield in diseased plants, chiefly due to reduced boll formation, in comparison with healthy ones, fluctuated between 35·5 and 54·2 per cent. In some varieties the yield of lint was reduced by 1·1 to 2·7 per cent. and the staple was shorter by 1·9 mm. Experiments with Maarad 1591 showed that the incidence of infection amounted to 11 per cent. when planting at 74 by 25 cm. and to 42·2 per cent. when planting at 80 by 80 cm.

HANSFORD (C. G.) & HOSKING (H. R.). **Recent research in Uganda on blackarm disease.**—*Emp. Cott. Gr. Rev.*, xv, 1, pp. 7–13, 1938.

Most of the information given in this brief review of the work done on cotton blackarm (*Bacterium malvacearum*) in Uganda since 1932 has already been noticed from other sources [cf. *R.A.M.*, xvi, p. 455; xvii, p. 315]. No correlation has been established locally between the disease and insect pests, except that the ragged edges of leaves attacked by *Lygus* are rather more susceptible than undamaged leaves, but this enhanced susceptibility does not result in increased stem infection.

LEHMAN (S. G.). **Seed infestation with Glomerella and Fusarium in the 1936 Cotton crop in North Carolina.**—*Plant Dis. Reptr*, xxii, 1, pp. 4–6, 1938. [Mimeographed.]

In germination and disease tests made in February and March, 1937, on 35 lots of untreated cotton seed from 35 different farms in 19 counties in North Carolina an average of 81 per cent. of the seeds germinated. In all except 4 lots, 40 per cent. at least of the seeds showed the presence

of *Glomerella gossypii* [*R.A.M.*, xvi, pp. 410, 606], the range of percentage infection being 4 to 96, with a mean of 65·9. The average percentage of seeds bearing spores or mycelium of *Fusarium* was 31·4, *F. moniliforme* [*Gibberella moniliformis*: loc. cit.] being observed on many of the seedlings. In June, 1937 additional tests were made on seed from 24 of the same lots after delinting in acid and disinfection with mercuric chloride. The mean percentages of infection by *G. gossypii* and *Fusarium* spp. were only 8·1 and 6·3 per cent., respectively, the incomplete elimination of these fungi by the treatment being probably due to internal seed infection.

Singh (B. N.) & Choudhri (R. S.). **The effect of visible, ultra-violet and infra-red radiations upon the germination and the therapeutic treatment of Cotton seed.**—*Emp. Cott. Gr. Rev.*, xv, 1, pp. 35–42, 1 pl., 1938.

When cotton seeds artificially inoculated with various [unspecified] fungi were given (1) 5 minutes' exposure to mixed ultra-violet and infra-red radiation at 2 ft., (2) 2½ minutes' exposure to mixed radiation plus the same exposure to ultra-violet radiation at 2 ft., and (3) as in (2) but at distances of 2 ft. for the ultra-violet and 4 ft. for the infra-red, the fungi were killed in all cases, as compared with 100 per cent. survival in the case of the unexposed controls. Injury to the seed was roughly proportional to the intensity and duration of infra-red radiation, prolonged exposure to which from short distances inhibited germination. It is concluded that ultra-violet radiation may safely be used for the surface sterilization of cotton seeds, but when fungal infection is deep, complete control is secured only by the combination of ultra-violet and infra-red rays.

Bréjoux (D.). **L'utilisation de microbes pathogènes dans la lutte contre la Pyrale, l'Eudémis et la Cochylis.** [The use of pathogenic microbes in the campaign against *Pyralis*, *Eudemis*, and *Cochylis*.]—*Agric. prat., Paris*, N.S., cii, 2, pp. 56–57, 1938.

In connexion with a brief survey of the system of combating insect pests by spraying their hosts with spore emulsions of pathogenic bacteria [*R.A.M.*, xvii, p. 35] at the rate of 1 gm. per l. water, the writer cites some figures illustrating the results of tests on these lines made by Métalnikov for the control of *Eudemis* [*Polychrosis botrana*] on vines in various parts of France. In one locality, 5,224 grapes on 100 control bunches were infested, the corresponding number for 100 treated bunches being only 416; the yield of a chemically treated plot amounted to only 320 kg. compared with 657 kg. in a similar plot sprayed with bacterial spores. In another district there were 16,350 grapes attacked in the control plot and only 1,884 in the sprayed one. With other data of a comparable order, these results indicate an efficiency of 90 per cent. for the method.

Martin (D. S.) & Conant (N. F.). **A comparative study of nineteen strains of Blastomyces dermatitidis Gilchrist and Stokes, 1898.**—Abs. in *J. Bact.*, xxxv, 1, pp. 38–39, 1938.

Since *Blastomyces* [*Endomyces*] *dermatitidis* [*R.A.M.*, xvii, p. 178]

was isolated from American blastomycosis, and described under that name by Gilchrist and Stokes in 1898, various other names have been applied to the same fungus. A comparison of 19 strains, including 13 cultures previously labelled *B. dermatitidis*, was made at the Duke University School of Medicine, Durham, North Carolina, with cultures of *Glenospora gammeli*, *Blastomycoides tulanensis*, *Monosporium tulanense* [ibid., xv, p. 295], and *E. capsulatus* and its var. *isabellinus* [ibid., xiv, p. 582]. No essential differences between the different strains were noticeable in culture and all the strains were further shown by serological tests to be similar in their antigenic structure. It is concluded, on the basis of these observations, that 21 names [which are listed] should be reduced to synonymy with *Blastomyces dermatitidis*, the sole agent of Gilchrist's disease.

Zelman (J.). **Disseminated coccidioidal granuloma.**—*Calif. West. Med.*, xlvii, 5, pp. 327–329, 2 figs., 1937.

Full clinical details are given of a fatal case of disseminated coccidioidal granuloma (*Coccidioides*) [*immitis*: *R.A.M.*, xvii, p. 112] in a 36-year-old white male at the San Diego County Hospital, California.

Levin (E. A.). **Torula infection of the central nervous system.**—*Arch. intern. Med.*, lix, 4, pp. 667–684, 7 figs., 1937.

A detailed account is given of two cases (both men) at the Cleveland (United States) City Hospital of torulosis of the central nervous system caused by *Torula histolytica* [*Debaryomyces neoformans*: *R.A.M.*, xvii, p. 111], bringing the total number of records of this disease to sixty.

Castellani (A.). **A short general account for medical men of the genus Monilia, Persoon, 1937. Em. Bonorden, 1851; Vuillemin, 1911; Castellani and Chalmers, 1919; Pollacci and Nannizzi, 1927.**—*J. trop. Med. (Hyg.)*, xl, 23, pp. 293–307, 17 figs., 1937.

A concise account is given of the taxonomy, cultural and biological characters, pathogenicity to man and animals, and morphology of the genus *Monilia* [*Candida*], illustrated by a number of representative species [cf. *R.A.M.*, xvi, p. 176 *et passim*].

Wickerham (L. J.) & Rettger (L. F.). **A study of Monilia albicans with emphasis on morphological types and chlamydospore production.**—Abs. in *J. Bact.*, xxxv, 1, p. 39, 1938.

Forty-seven strains of *Monilia* [*Candida*] *albicans* [*R.A.M.*, xvii, p. 176] isolated from human, and 10 from avian, sources were studied by a modification of Dalmau's technique and found to be arbitrarily divisible into four overlapping types and a fifth group composed of a few degenerate strains. The fermentation reactions for the four main types were identical, and all produced chlamydospores in 96 hours. The only other closely related fungi forming these organs are *Endomyces* spp., which are readily separable from the *Monilia* groups by their production of ascospores on maize meal agar. The early development of chlamydospores of distinctive appearance is therefore thought to constitute an important diagnostic feature of *C. albicans*.

Keiper (T. W.). **Studies on yeastlike fungi isolated from pulmonary disease (bronchomoniliasis).**—*J. Lab. clin. Med.*, xxiii, 4, pp. 343–354, 4 figs., 1938.

Three out of 100 students examined at Stanford University (United States) were found to harbour species of *Monilia* [*Candida*] in their throats. The incidence of pulmonary disease [*R.A.M.*, xvii, p. 320] caused by these organisms in 178 cases was 2·93 per cent. The ability to utilize carbohydrates with the production of acid, or acid and gas combined, was not found to be a reliable criterion for the classification of these organisms, supplementary precipitin and agglutinin absorption trials being required. The fungi concerned in the cases under observation were *M.* [*C.*] *albicans, M.* [*C.*] *psilosis*, and *M. candida* [*C. vulgaris*: ibid., xvi, p. 811].

Schonwald (P.). **Allergenic molds in the Pacific Northwest.**—*J. Allergy*, ix, 2, pp. 175–179, 2 graphs, 2 charts, 1938.

Air-borne spores of *Rhizopus nigricans*, *Penicillium expansum*, *Trichoderma koningi*, and seven other moulds were trapped on 145 plates exposed throughout the year 1936 in the city of Seattle, Washington, in residential districts, and at various points along the Pacific Northwest coast [cf. *R.A.M.*, xvii, p. 243]. Of 150 cases tested by the scratch and intradermal methods, only five failed to react to any of the mould extracts. Of 86 patients treated with these preparations, 66 (76·7 per cent.) showed definite improvement in a comparatively short time, the relief thus obtained also extending to other forms of abnormal sensitization, such as asthma, rhinitis, hay-fever, dermatitis, eczema, and so forth.

Milochevitch (S.) **Neue Auffassungen über die Ätiologie des Favus beim Menschen.** [New ideas concerning the etiology of human favus.]—*Med. Rev., Belgrade*, xii, pp. 81–85, 1937. [Serbocroatian, with French summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 8–9, p. 570, 1938.]

According to Sabouraud, *Achorion gypseum* and *A. schoenleini* are alone capable of inducing favus capillitii. The changes caused in the glabrous skin by *A. violaceum* [*R.A.M.*, xvi, p. 253] are not, apart from scutulum formation, characteristic of favus, and it would be more correct to refer such cases to *Trichophyton violaceum* [ibid., xvii, p. 321]. *T. album* [loc. cit.], however, is certainly able to provoke typical favus of the scalp, and a differential mycological diagnosis between this fungus and *A. schoenleini* can only be established by the behaviour of the two organisms in the hair. It is considered probable that *A. schoenleini* is merely a derivative of *T. album*, which also comprises, for example, *T. discoides* and *T. ochraceum* as representatives of the large-spored faviform group [cf. ibid., xvi, p. 810].

Allison (C. C.) & Christensen (J. J.). **Studies on inheritance of resistance to wilt in Flax.**—Abs. in *Phytopathology*, xxviii, 1, p. 1, 1938.

From 1934 to 1937 the inheritance of resistance of flax to wilt (*Fusarium lini*) was studied in the progeny of 56 crosses involving 18 varieties

differing noticeably in their reaction to the disease (5 to 100 per cent. infection) in flax-sick soil. In general, the F_1 crosses were intermediate in resistance between the two parents, although in certain crosses susceptibility or resistance appeared to be dominant. The types of segregation observed in the F_2, F_3, and F_4 denote the existence of several factors for resistance. When Bison [*R.A.M.*, xi, p. 182; xvi, p. 41] was used as the resistant parent, the percentage of resistant segregates obtained usually exceeded the number derived from other equally resistant varieties. Some F_4 and F_5 progenies of crosses between Bison (wilt-resistant but susceptible to rust [*Melampsora lini*]) and Newland (very susceptible to wilt but immune from rust) are resistant to both diseases, besides possessing certain desirable agricultural characters.

Pavloushin (P. J.). Активные методы выявления устойчивых к болезням сортов Льна. [Methods for testing varieties of Flax for resistance to diseases.]—*Pl. Prot., Leningr., 1937*, 15, pp. 34–43, 1 graph, 1937. [English summary.]

The following 'provocative' method is recommended in breeding flax varieties resistant to fungous diseases [see preceding abstract]. The reaction of varieties to *Fusarium lini* can be well shown by inoculating the soil with infected straw 4 to 6 days before sowing and keeping the soil well moistened during the growing period. The straw is introduced into the soil at a depth of 3 cm. in small fragments 1 to 1·5 cm. in length, at a rate of 50 to 100 gm. per sq. m. The reaction to *Melampsora lini* is sufficiently demonstrated by late and thin sowing and abundant nitrogen fertilization. The reaction to *Polyspora lini* can be best seen when the plant is infected with a pure culture of this fungus in the period between the bud stage and flowering.

Green (D. E.). **Antirrhinum rust.**—*J. R. hort. Soc.*, lxii, 12, pp. 530–537, 1937.

Summing up the present position with regard to *Antirrhinum* [*majus*] rust [*Puccinia antirrhini*] in Great Britain [*R.A.M.*, xvi, p. 678], the writer states that the American varieties now undergoing resistance tests at the Royal Horticultural Society's Garden, Wisley, Surrey, do actually escape infection to the extent of 75 per cent. of the plants, as claimed by their originators, though the remaining 25 per cent. may be infected quite severely. Attempts are now in progress to improve the somewhat dull colour of these resistant stocks by back-crossing with susceptible parents of more pleasing appearance, and promising results have already been obtained along these lines, especially with the tall yellow varieties. In the 1937 tests, all four old varieties succumbed to the rust in August, one out of six Wisley-raised stocks showed every plant diseased, while in the remaining five resistance ranged from 50 to 76 per cent.; in two out of eight American varieties every plant was free from infection, and the remainder were from 73 to 91 per cent. resistant.

Mains (E. B.). **Additional studies concerning the rust of Iris, Puccinia iridis.**—*Phytopathology*, xxviii, 1, pp. 67–71, 1938.

Certain bearded *Iris* varieties, e.g., Ivory Coast, Leonato, San Rafael,

Santa Fe, and *I. longipetala*, at Berkeley, California, were reported by M. W. Gardner in 1934 to suffer severely from rust (*Puccinia iridis*) [*R.A.M.*, xv, p. 99]. The physiologic race of the rust concerned in the outbreak is a hitherto unnamed one, to which the designation *californica* is here applied. In the writer's inoculation experiments most of the bearded varieties proved highly resistant to the new race, which caused a moderate degree of infection, however, on Magnifica, Oruga, and San Rafael, while none was infected by *P. iridis* race *septentrionalis*. On the other hand, all the English *Iris* varieties tested were very susceptible to both races: among the Spanish and Dutch varieties outstanding resistance was shown by Cajanus, David Bliss, Imperator, King of Blues, and Wedgwood.

D'Oliveira (Maria de L.). **Uma doença bacteriana do Ligustrum japonicum, Thumb.** [A bacterial disease of *Ligustrum japonicum*, Thumb.]—*Rev. agron.*, xxiv, 4, pp. 425–435, 4 figs., 1936. [English summary. Received April, 1938.]

Privet (*Ligustrum japonicum*) in the Lisbon district of Portugal is stated to suffer from an apparently undescribed bacterial disease characterized by the presence on the leaves of small, circular, black spots, sometimes very numerous, and general slight stunting of the whole plant. The causal organism, *Bacterium ligustri* n.sp., closely resembles *Bact.* [*Pseudomonas*] *syringae*, from which it differs, however, in carbohydrate fermentation and other minor reactions. *Bact. ligustri* is a rod with rounded ends, occurring singly or in pairs and measuring 1·3 to 3 by 0·5 to 0·7 μ, motile by 2 to 5 polar flagella, Gram-negative, non-acid-fast, liquefying gelatine, forming white colonies on agar media, with a conspicuous greenish pigment on Dox's agar, not reducing nitrates or producing ammonia or indol, coagulating milk, making no growth on Cohn's solution but developing freely on Fermi's and Uschinsky's, with pigmentation, and evolving no gas from carbohydrates but acid from galactose, arabinose, and mannose. Entry into the plant was experimentally shown to be gained exclusively through wounds, such as those inflicted by severe pruning under natural conditions.

Buddin (W.) & Wakefield (E[lsie] M.). **Stem-canker of Gardenias.**—*Gdnrs' Chron.*, ciii, 2664, p. 45, 1 fig., 1938.

A Latin diagnosis is given of *Phomopsis gardeniae* n.sp., the agent of stem canker of *Gardenia* in England [*R.A.M.*, xvi, p. 614; cf. next abstract]. On re-examination, after an interval of six months, of subcultures of the fungus on sterilized *Gardenia* twigs B spores were detected in profusion among the A spores previously described, the former being filiform, curved or hook-shaped, and measuring 25 by 1 μ.

Hansen (H. N.) & Barrett (J. T.). **Gardenia canker.**—*Mycologia*, xxx, 1, pp. 15–19, 1 pl., 1938.

Details are given of morphological and cultural studies in Berkeley, California, of the species of *Phomopsis* first recorded in that State in 1932 [*R.A.M.*, xiii, p. 379] causing stem canker and galls on gardenias, and which has since been also reported from several other of the United States and from England [see preceding abstract]. Comparisons of the

Californian fungus with isolates from Illinois, Kansas, and Washington, showed that all were apparently identical. The organism is characterized by its irregular zonate type of growth in culture, with dispersed pycnidia produced in abundance to within 5 mm. of the outer margin, and also by the fact that the A type spores contain many oil globules instead of the two typical for the genus. It is considered to be new to science and is named *P. gardeniae* [with a Latin diagnosis]. The conidiophores are hyaline, awl-shaped, 12 to 18 by 2·5 to 3·3 μ. The A spores are continuous, hyaline, elliptical-fusiform, 6·8 to 12·3 by 2·7 to 4·3 μ (mostly 8·5 to 10·2 by 3·2 to 3·6 μ), and the B spores are continuous, hyaline, filiform, curved or flexuous, and 13·6 to 32·5 by 1·1 to 2·1 μ (mostly 18·2 to 27·2 by 1·4 to 1·8 μ). [This species, published on 1st February, 1938, is antedated by *P. gardeniae* Budd. & Wakef., dated 15th January, 1938: loc. cit.]

HAGEMANN (H.). **Neue Wege im Kampfe gegen Schädlingsbefall in der Staudenanzucht.** [New methods in the campaign against diseases in the cultivation of shrubs.]—*Blumen u. PflBau ver. Gartenwelt*, xlii, 1, pp. 5–6, 1 fig., 1938.

It has repeatedly been observed of late in Germany that flowering plants and shrubs ordinarily regarded as disease-resistant have suddenly been attacked by fungal pathogens, a recent example being the infection of *Pyracantha coccinea* by *Fusicladium* [*pirinum* var. *pyracanthae*: *R.A.M.*, xvi, p. 515]. The phenomenon is attributed to the widespread practice of mass cultivation of a single plant species ('monoculture'), which affords particularly favourable conditions for fungal invasion, and attempts are in progress in a nursery-garden at Bornim to remedy the situation by the introduction of a more natural system of mixed plantings. For instance, the interposition of *Avena candida* and *Koeleria glauca* between *Viola cornuta* and *Phlox subulata*, both subject to rusts [*Puccinia violae*: ibid., xiii, p. 532, and *P.* sp., respectively] completely eliminated the diseases. The plants used for interplanting should differ as widely as possible in growth habit from those to be protected.

WILLIS (L. G.) & PILAND (J. R.). **A response of Alfalfa to borax.**—*J. Amer. Soc. Agron.*, xxx, 1, pp. 63–67, 2 figs., 1938.

Continuing their studies on the yellowing of lucerne due to boron deficiency in North Carolina [*R.A.M.*, xvii, p. 44], the writers found that a combination of copper, manganese, and zinc sulphates at the rates of 5, 10, and 10 lb. per acre, respectively, produced similar beneficial effects to those obtained with borax (5 to 10 lb.). At the outset the disorder was thought to be confined to sandy soils, but further observations have shown it to be general in lucerne fields throughout the State.

RASMUSSEN (E. J.). **Effect of delay in storage and storage temperature on the keeping qualities of Apples.**—*Tech. Bull. N. H. agric. Exp. Sta.* 67, 55 pp., 10 figs., 2 graphs, 1937.

During the five years' apple storage investigations commencing in 1930 at the New Hampshire Agricultural Experiment Station, temperature was found to be one of the most important factors influencing

keeping quality. In common storage McIntosh declines rapidly in firmness and acidity, but develops the best flavour and aroma; this variety is in prime eating condition a month after harvest. At 30° F. firmness and acidity are retained, but brown core [*R.A.M.*, xv, p. 485] is prevalent and the characteristic flavour does not develop. At 32° brown core is less in evidence and the taste of the fruit in mid-winter is somewhat superior. By 10th May wastage was greater in McIntosh apples stored immediately after picking than in the lots delayed for five days, owing to the abundant development of brown core in the former. The fruit delayed for ten days before storage showed 43 per cent. wastage on the same date, or twice as much as that stored immediately and less than half the incidence in the apples kept for 20 days prior to storage. Other cases of wastage in this variety include [unspecified] decay, external and internal breakdown [ibid., xvi, p. 468], and mealy breakdown [ibid., xiv, p. 592].

Similar considerations apply in general to Baldwins, the causes of wastage in which, besides the foregoing, include bitter pit.

Apple scab [*Venturia inaequalis*] lesions were found to increase in size during common storage by up to 43·4 per cent. on Baldwins, the corresponding figure for fruit kept at 30° being 30·4 (9th March). In the case of McIntosh the increase on the same date on fruit in common storage was 8·8 and on that kept at 30° 3·3 per cent. [ibid., xvii, p. 117]. Late infections develop more rapidly than early ones.

Too early harvesting of Cortland apples results in the development of scald [ibid., xv, p. 485] in storage, while undue delay is apt to lead to breakdown. Fruit harvested with a tinge of yellow in the ground colour (10th October in 1933) was observed to show very little scald in storage.

RIGG (T.) & CHITTENDEN (E.). **Influence of manurial treatment on yield and storage quality of Cox's Orange variety of Apples.**—Reprinted from *Orchard. N. Z.*, x, pp. 272–274, 1937.

The application to Cox's Orange apples on a poor phase of the Moutere Hills, Nelson, New Zealand, where this variety is extensively grown, of a top dressing of 3 lb. ammonium sulphate per tree about the third week in September has been found, in six years' observations (1931–6), to induce fairly high percentages of [unspecified] fungal decay and internal breakdown [see preceding abstract] in cool storage (38 °F.).

BAINES (R. C.). **Phytophthora trunk canker of Apple.**—Abs. in *Phytopathology*, xxviii, 1, p. 2, 1938.

Physiologic races of *Phytophthora cactorum* were differentiated [? in Indiana] on the basis of their varying pathogenicity in inoculation experiments from pure cultures into the trunks of 10- and 11-year-old Gano, Grimes, King, Northwestern Greening, Rome, Smokehouse, and Stark apple trees [*R.A.M.*, xv, p. 633; xvii, p. 254]. A culture of the fungus from *Lilium candidum* infected the varieties King, Rome, and Stark, one from lilac [ibid., xi, p. 579] attacked King, and one from loquat was pathogenic to Grimes, King, Northwestern Greening, Rome, and Stark.

Single cultures isolated from apple, citrus, peony, pine, and snapdragon [*Antirrhinum majus*: ibid., xv, p. 518] failed to infect the above-mentioned seven apple varieties and 24 others resistant to the fungus. Seven of the 8 cultures isolated from bark cankers, 3 out of 4 from apple fruits, 1 of the 2 from peony, and 2 from soil were pathogenic to Grimes. The trunks of 2-, 3-, and 4-year-old Grimes were resistant to infection, while those of 8- to 30-year-old trees of this variety were susceptible. Large branches were more resistant than the trunks.

CAMPAGNA (E.). **Observations préliminaires sur la rouille du Pommier dans le Québec.** [Preliminary observations on Apple rust in Quebec.]—*Bonne Terre*, xix, 1–2, pp. 15–30, 6 figs., 2 maps, 1938.

A brief, semi-popular account is given of the symptoms, life-cycle, etiology, and control of apple rust (*Gymnosporangium clavipes*) [*R.A.M.*, xvi, p. 618], with notes on its distribution and economic importance in Quebec. The disease was first observed in the province in 1929, on about a dozen Jaune Transparente and McIntosh fruits; a year later, about 15 trees were found to be affected, and by 1932 the number had risen to several hundreds. The affected locality extends from Montmagny to Rivière du Loup. The disease cannot spread farther west than the eastern extremity of the Ile d'Orléans as between this and the American frontier no juniper trees (*Juniperus communis* var. *depressa*) appear to be present. The area that may, however, become affected contains about 83,962 apple trees. Observations on about 500 trees in an orchard at Sainte-Anne in 1934 showed the following varieties to be unaffected, viz., Golden Russet, Pewaukee, Pêche, Astrachan, Hyslop, and Martha, the following (arranged in order of decreasing susceptibility) being affected: Alexandre, St. Laurent, Excelsior, Greening, Duchesse, McIntosh, Toleman, Milwaukee, and Wealthy.

The host range of the different stages of the rust on Pinaceae and Pomaceae near Quebec is given. It is recommended that no junipers be planted in the regions where they are not found.

YOUNG (H. C.) & WINTER (H. F.). **The effect of boron, manganese, and zinc on the control of Apple measles.**—*Bi-m. Bull. Ohio agric. Exp. Sta.*, xxii, 188, pp. 147–152, 5 figs., 1937.

In a test carried out in Ohio to ascertain the effect of minor elements on the control of apple measles [*R.A.M.*, xvi, p. 440], in which Red Delicious trees were grown in sand cultures with a complete nutrient solution with and without the addition of boron, manganese, and zinc, the results obtained strongly indicated that lack of boron in a growing Delicious apple tree is the cause of much of the condition known as internal bark necrosis [ibid., xiv, p. 372]. While the experiment did not prove that the pimply, necrotic condition that developed was identical with measles, the necrosis induced was macro- and microscopically indistinguishable from measles. Boron corrected this condition. Although no definite recommendations are made from these results, it is suggested that borax applications might be made tentatively to affected apple trees at rates ranging from $\frac{1}{8}$ to $\frac{1}{4}$ lb. per year of growth.

HILDEBRAND (E. M.). **The blossom-blight phase of fire blight, and methods of control.**—*Mem. Cornell agric. Exp. Sta.* 207, 40 pp., 3 pl., 5 figs, 1937.

Investigations carried out at Cornell during a period of four years on the control of the blossom blight phase of fireblight [*Erwinia amylovora*: *R.A.M.*, xvii, p. 48] of apple, pear, and quince trees demonstrated it to be an essential supplement to canker eradication. Under field conditions, Bordeaux mixture (1–3–50) and copper-lime dust (20–80) caused no appreciable reduction in fruit set under good pollination conditions. Under laboratory conditions, low concentrations of bactericides, such as would be used in the field, acted as repellants to bees, but lengthened their life. Field observations indicated that blossom bactericides had no deleterious effect on bees.

The bacteria enter unwounded flowers through the intercellular spaces, stomata, nectar-secreting stomata, and, possibly, hydathodes. The only place in which the organism was conclusively demonstrated to overwinter was in the tree cankers; it is very unlikely that overwintering occurs in the beehive. Greenhouse tests on dwarf pear trees showed that the blossoms were most susceptible to infection during the two days after opening, susceptibility subsequently declining.

Field experiments demonstrated that the most effective single application was that made at full bloom. Of the materials tested, Bordeaux mixture (1–3–50) and copper-lime dust (20–80) gave the best control. In one orchard in 1933, the early- and full-blossom applications of Bordeaux mixture (1–3–50) reduced blossom blight of apple trees by 40 and 57 per cent., respectively, combined early- and full-blossom treatment reducing it by 67 per cent. Results obtained in other orchards in the same year and succeeding ones demonstrated that the full-bloom application was of more value than any other single treatment, though under certain conditions the early-bloom application was of almost equal importance, in which case two applications were particularly effective. In limited trials, cuprous oxide, copper phosphate [ibid., xvii, pp. 224, 260], and coposil [ibid., xvii, p. 223] showed promise.

DEMAREE (J. B.) & DARROW (G. M.). **The red-stele root disease of Strawberries in the north-eastern United States.**—*Plant Dis. Reptr*, xxi, 22, pp. 394–399, 1937. [Mimeographed.]

A strawberry disease first recorded by H. W. Anderson in 1935 from widely separated localities in Illinois and the neighbouring States under the name 'black stele' root disease, but now termed 'red stele' was observed in 1936 and again in 1937 in the Eastern Shore district of Maryland. Numerous affected plants were found, showing a typically discoloured central cylinder in the larger fleshy roots. Many plants in a one-year-old field were wilting, and others were stunted, and had small, reddish leaves on short petioles. The disease was also observed in New Jersey, New York, Michigan, and Virginia, being most prevalent at three localities in Maryland, where the plants were growing in low, wet, unsuitable situations. It appeared to be limited everywhere to a very small percentage of the acreage planted to strawberries, and to be of minor importance. A Pythiaceous fungus with abundant, large,

thick-walled bodies, presumably oospores, was commonly present in the reddened stele of affected roots, and has been readily cultured.

It is doubtful, however, whether red stele is identical with the red core disease in Scotland due to *Phytophthora* sp. [allied to *P. cinnamomi*: *R.A.M.*, xvi, p. 515] as, apart from the low virulence of the former disease, there seems to be some difference in the symptoms, the fleshy roots affected by red stele being white and without any external sign of disease, and furthermore the red stele fungus has not been found in the cortex.

Demaree (J. B.) & Darrow (G. M.). **Leaf variegation in Strawberries not considered a virus disease.**—*Plant Dis. Reptr*, xxi, 22, pp. 400–403, 1937. [Mimeographed.]

The strawberry leaf yellowing and variegation known variously as 'June yellows', 'gold leaf', and 'suspected mosaic', [*R.A.M.*, xiii, p. 40; xvi, pp. 439, 545] has become so serious on the Blakemore variety in the United States since 1933, that nearly all the plantings observed by the authors showed the condition, which in some cases affected 25 to 50 per cent., and in extreme cases all, of the plants. Numerous other commercial varieties in widely separated localities are attacked, as are all the principal wild species. The evidence obtained by various workers points to the disease being non-infective, while careful breeding work has indicated that its origin is probably genetic, suggesting that it results from sporting or mutation, is a genetic weakness of the varieties affected, and is not due to a virus. The discovery and propagation of varieties which are not affected, or turn yellow slowly, offers an immediately practical method of control.

Demaree (J. B.) & Wilcox (Marguerite S.). **The black-seed disease of Strawberry.**—Abs. in *Phytopathology*, xxviii, 1, p. 6, 1938.

Serious damage to strawberry fruits is occasionally caused in Maryland and North Carolina by the ordinarily unimportant foliar pathogen, *Mycosphaerella fragariae* [*R.A.M.*, xvi, p. 394], which produces the so-called 'black seed' disease. The blackened achenes are conspicuous on the white unripe fruits and on ripe fruits of pale-coloured varieties. The affected berries usually bear only one or two spots, but as many as eight or ten may be detected in rare cases. Infection is believed to occur by way of the stigma, the fungus (which culturally and morphologically resembles the conidial stage of *M. fragariae*) ramifying throughout the seed and closely associated pulpy tissues. The typical symptoms of the disease were induced in the greenhouse by the inoculation of young berries with cultures isolated from the infected fruit tissue, leaf spot lesions, and ascospores of the fungus. Characteristic foliar injuries were also produced by the inoculation of young leaves with cultures isolated from 'black seed' berry tissues.

Bain (H. F.). **Production of synthetic mycorrhiza in the cultivated Cranberry.**—*J. agric. Res.*, lvi, 11, pp. 811–835, 10 pl., 1937 (issued February, 1938).

After reviewing the work hitherto done by Miss Rayner and others on the mycorrhiza in the Ericaceae [*R.A.M.*, xv, p. 308 *et passim*], the

author gives a fully illustrated account of his investigations since 1932, in the course of which he isolated four mycorrhizal fungi from 'hyphal complex' cells in the roots of *Vaccinium macrocarpum*, *V. canadense*, *Chamaedaphne calyculata*, and *Ledum groenlandicum*. The four organisms were grown in pure culture, and although they failed to produce fructifications permitting of their identification, they were obviously specifically distinct from one another and from *Phoma radicis* as described in the literature, or when compared with a culture of *P. radicis callunae* Rayner, obtained from the Centralbureau voor Schimmelcultures, Baarn. All four reproduced the complex form of mycorrhiza in cranberry seedlings grown in sterilized agar, and the fungus from cranberry also produced mycorrhiza in cranberry seedlings grown in an inoculated artificial soil composed of ground cork and sand. No mycorrhiza developed in seedlings grown in artificial media in the absence of the endophytes. Experiments with synthetic media showed that the cranberry fungus produced the mycorrhiza more freely if carbohydrates were lacking, and that seedlings grown in nutrient-free distilled water agar derived no measurable benefit from the presence of mycorrhiza. Cranberry roots were further shown to be highly sensitive to the composition of the nutrient media, the toxicity of which to the roots was increased in certain cases in the presence of the endophytes, while the toxicity of certain other substrata was decidedly reduced. These changes in the media were not correlated with mycorrhizal infection. No evidence of systemic infection of the type attributed by some investigators to *P. radicis* could be found either in the seedlings or in prepared slides from field material, and until the invariable existence of systemic infection is more conclusively demonstrated, and more definite proof is forthcoming that root suppression is due to lack of such infection, the hypothesis of an obligate relationship of mycorrhizal fungi to root formation in the Ericaceae is not considered valid.

Brown (Nellie A.). **Blueberry galls produced by the fungus Phomopsis.**—*Phytopathology*, xxviii, 1, pp. 71–73, 1 fig., 1938.

Blueberries [*Vaccinium* spp.] of the Cabot and Pioneer varieties in Massachusetts, New Jersey, Oregon, and Michigan are liable to a disease characterized by the formation on the crown and along the stem of light-coloured, later darkening, nodular growths protruding 5 mm. to 3 cm. or more from the surface and closely resembling those due to crown gall (*Bacterium tumefaciens*), but experimentally shown to be caused by a species of *Phomopsis*, which was also pathogenic to *Viburnum opulus* and *Jasminum nudiflorum* [*R.A.M.*, xiv, p. 174; xvi, p. 41]. The trouble may be effectively combated by reasonable care in propagation and by the destruction of infected parts during the autumn.

Baker (R. E. D.). **Notes on the control of Mango anthracnose (Colletotrichum gloeosporioides).**—*Trop. Agriculture, Trin.*, xv, 1, pp. 12–14, 1 graph, 1938.

The author states that in Trinidad and other West Indian Islands some of the more valuable mango varieties are often severely attacked by *Colletotrichum gloeosporioides* [*R.A.M.*, xvi, p. 301], which causes a serious blossom blight and a typical anthracnose of the ripening fruit;

the latter condition is characterized by the development, at about the time that the fruit attains maturity, of black spots, which gradually become sunken and coalesce, until in a few days at tropical temperatures the whole fruit is involved. The spots are often concentrated at the stem end and sometimes in stripes down the sides of the fruit, suggesting the distribution of the spores by rainwater over the surface of the fruit. Details are given of an attempt to control both blossom blight and anthracnose in 1937 on four Julie mango trees by weekly spraying of the flower spikes and fruits with 1 per cent. Burgundy mixture from the time of the formation of the first flowers in January until the fruit was harvested between May and July. The control of blossom blight was not very satisfactory, but the difference between the fruit collected from the sprayed trees on 7th and 18th May and 24th June and stored at tropical temperatures and the controls was striking; on the unsprayed mangoes latent anthracnose infections became visible as the fruit began to ripen, and three or four days after ripening had commenced the fruit was usually completely black and worthless; on the sprayed fruits, on the other hand, very few or no spots at all developed, the mangoes ripened five or six days after picking, and remained in good condition sometimes for as long as six or seven days after they had ripened. Washing the fruit in running water and drying with a clean cloth immediately after picking had no effect on the incidence of anthracnose, showing conclusively that the latent infections were established before the fruit was harvested. In view of these promising results further experiments are planned for determining the minimum number of sprayings required and the best times of application.

[Barnes (A. C.)]. **Leaf spot disease of Bananas.**—*J. Jamaica agric. Soc.*, xli, 12, pp. 603–607, 1937.

At a meeting of the Board of Management of the Jamaica Agricultural Society on 1st December, 1937, the Director of Agriculture stated that the indications at present are that banana leaf disease [*Cercospora musae*: see above, p. 375] will be confined locally to areas where the conditions for cultivation are not wholly favourable. A year ago considerable alarm was felt in some of the infected districts, but when the time arrived for preventive measures to be applied most of the affected plants had almost recovered. The disease is not a limiting factor to production in localities where the growing conditions are favourable. Actually, infection is present all over the island, but in St. Mary, Portland, and St. Thomas only a few spots are found, and those only on the oldest leaves. In a very mild form the disease has probably been present in Jamaica for a long time.

Fifteen months' work by the Department of Agriculture showed that, where the conditions justify the procedure and infection is serious, spraying or dusting should begin about the middle of March, and continue at intervals of three weeks until the end of April or the beginning of May. Treatment should be resumed in July, and continued until the beginning of October. In areas of high production it should continue throughout the whole year. Spraying with Bordeaux mixture is more effective than dusting; the spray should be applied effectively to the newest leaves just unfolding, and a few older ones. Owing to

the practical difficulties involved, however, dusting with finely ground copper sulphate and lime is preferable to spraying. The total cost of each application of dust amounts to about 8*s*. per acre.

CRANDALL (B. S.). **Persimmon wilt.**—*Plant Dis. Reptr*, xxi, 18, p. 338, 1 map, 1937. [Mimeographed.]

The only locality in the United States where persimmon wilt, caused by a species of *Cephalosporium*, has so far been found is an area of about 1,500 square miles south of the Cumberland river, in Tennessee, where about 50 per cent. of the stands contain infected trees.

ANAGNOSTOPOULOS (P. T.). *Τὸ κυκλοκόνιον τῆς Ἐλαίας ἐν Ἑλλάδι.* [The *Cycloconium* of the Olive in Greece.]—*Hort. Res., Athens, 1937*, 4, pp. 357–367, 3 figs., 1937. [English summary. Received April, 1938.]

Severe damage is stated to be caused to the Greek olive crop by *Cycloconium oleaginum* [*R.A.M.*, xvi, p. 546], especially in orchards where the cultivation of cereals and fodders among the trees depletes the soil of its natural moisture and inorganic matter. The observations herein reported were conducted on the Attic variety, which responded satisfactorily to cultural measures of control, including green manuring, two ploughings (October and February), pruning, irrigation, fertilizing, and wide spacing of the trees in unirrigated orchards. Under the adverse conditions indicated above even normally resistant varieties are prone to infection by *C. oleaginum*, which may result in extensive defoliation.

MONTGOMERY (H. B. S.) & MOORE (M. H.). **A laboratory method for testing the toxicity of protective fungicides.**—*J. Pomol.*, xv, 4, pp. 253–266, 1 pl., 1938.

Full details are given of the method devised by the authors for evaluating the toxicity of plant protectives [*R.A.M.*, xvii, p. 261], in which 0·015 c.c. of the preparation to be tested is spread with a fine-bore pipette over circular areas 15 mm. in diameter, delimited on glass slides; after evaporation of the liquid and desiccation of the deposit, 0·04 c.c. of a water suspension of washed conidia of *Venturia inaequalis* is applied in a similar manner, the slides are incubated in a saturated atmosphere at 20° C. for at least 24 hours, and the amount of germination of the spores is then recorded at intervals. If desired, the spray deposit may be washed with water [in a special apparatus the construction of which is described] before the conidial suspension is applied. A brief account is also given of a method of growing *V. inaequalis* in pure culture for the production of conidia, and of freeing the suspension from nutrients by centrifuging. A further method was worked out for rapidly assessing the results of the tests by classifying the mass appearance of the germination of the conidia into five categories.

The results obtained in a number of tests with copper- and sulphur-containing inorganic substances and with certain organic compounds indicated that this method is reliable for comparing fungicides in the laboratory, but whether there is a correlation between laboratory and field-test results remains to be investigated. Comparisons showed that

the lowest effective concentration of lime-sulphur in the field (1 per cent.) is three times that of the lowest effective concentration (0·33 per cent. unwashed) in the laboratory, while that of Bordeaux mixture in the field (0·2 per cent. copper sulphate) is sixteen times the lowest effective concentration in the laboratory (0·0125 per cent.). It seems probable that with widely differing fungicides different ratios will be found between the results obtained in the laboratory and in the field. Of the organic compounds tested, 8-hydroxyquinoline, salicylanilide, tetramethylthiuram sulphide, and tetramethylthiuram disulphide [ibid., xvi, p. 765] showed promise, and the last-named was included in field tests in 1937.

Spassky (A. F.). Комбинированный дестомеситель-бонификатор. [A machine for preparation of dusts.]—*Pl. Prot., Leningr., 1937*, 15, pp. 86–89, 1 diag., 1937.

This is a description of a machine devised by the author for the preparation of dusts, and the mixing of fungicides with insecticides, fillers, and oils, which increase the adhesive capacity of dusts. The materials are fed from hoppers into compression chambers (actuated by a rotary compressor driven by an internal-combustion engine) from which they are forced as jets which impinge upon one another. The resulting mixture then passes through a series of devices which complete mixing and pulverization.

Ogilvie (L.) & Hickman (C. J.). **Cuprous oxide and zinc oxide as seed protectants.**—*Gdnrs' Chron.*, ciii, 2666, pp. 79–80, 2 figs., 1938.

Cuprous oxide was found to be a much more effective protectant of pea seeds in soil contaminated with *Pythium ultimum* [*R.A.M.*, xvi, p. 781], one of the agents of seedling damping-off, than zinc oxide [ibid., xvii, p. 219] in recent experiments at the Long Ashton Research Station. The percentages of emergence were: untreated 3·3, zinc oxide treated 17·7, cuprous oxide treated 71·6. In the early 1937 sowings, moreover, Variety Surprise and Early Bird pea seed dusted with cuprous oxide germinated much more extensively than the controls, the percentages for the former variety sown on 25th February and 11th March being, respectively, 31·8 and 64·8 for the treated and 8·2 and 26·4 for the untreated, while the corresponding figures for the latter were 61·2 and 66·6, respectively, for the dusted seed, and 23 and 31·4 for the controls. At the later sowing dates the differences were not so marked. Cuprous oxide further increased the emergence of lettuce (by nearly 50 per cent.), cabbage, tomato, and sugar beet, and zinc oxide that of lettuce (66 per cent.), cabbage, tomato and turnip, while both stimulated emergence in a number of widely grown ornamentals. Small quantities of seed may be shaken up with the chemical in a dry glass jar, but for larger amounts a rotating churn with baffle plates is preferable. One level teaspoonful of the disinfectant (2·5 per cent. by weight) per lb. of seed is the normal dosage, but for large seeds, e.g., peas and cucumber, only about 0·25 per cent. by weight should be used [cf. ibid., xvii, p. 332]. Zinc oxide is more difficult and takes longer to apply than cuprous oxide, only the finest grades adhering properly to the seeds.

SCHULTZ (H.). **Pflanzenschutz in Zahlen.** [Plant protection in figures.] —*Zbl. Bakt.*, Abt. 2, xcvii, 18–22, pp. 413–429, 1938.

Statistics are furnished of the estimated damage caused in Germany and other countries by plant diseases and insect pests in various branches of agriculture, horticulture, silviculture, viticulture, fruit- and vegetable-growing, subtropical, and tropical crops, and stored products [cf. *R.A.M.*, xiv, p. 461 *et passim*], together with notes on damage by frost and hail and a discussion of the profitability of plant-protective measures. A three-page bibliography is appended.

WELLMAN (F. L.). **Poverty of human requisites in relation to inhibition of plant diseases.**—*Science*, N.S., lxxxvii, 2247, pp. 64–65, 1938.

In certain districts of Turkey, where extreme poverty prevails among the population due to the shortage of natural resources, plant diseases were found to be virtually absent, the inference being that the agricultural practices thereby necessitated entail the rapid disposal of infected material, e.g., as fodder, and so prevent the accumulation and spread of pathogenic organisms.

FRIEDRICHSOHN (G. A.). Обзор вирусных заболеваний сельскохозяйственных растений Саратовской области. [The virus diseases of crop plants in the Saratov region.]—*Pl. Prot., Leningr., 1937*, 14, pp. 105–107, 1937.

In this list of virus diseases of potato, tomato, cucurbits, fruit trees, and raspberries, encountered in the Saratov region, tomato aucuba mosaic and a disease provisionally identified as bunchy top of tomato [*R.A.M.*, xv, p. 124] are reported for the first time from the U.S.S.R.

STANLEY (W. M.). **Virus proteins—a new group of macromolecules.**—*J. phys. Chem.*, xlii, 1, pp. 55–70, 1 fig., 4 graphs, 1938.

This is an interesting survey of recent advances in the study of virus proteins, with special reference to their inclusion in the field of colloid chemistry as a new group of macromolecules. Several virus proteins, some from plant and others from animal and bacterial diseases, some larger and some smaller than the relatively immense tobacco mosaic virus protein [*R.A.M.*, xvii, p. 272], have been isolated and are undergoing investigation in various laboratories. Since the virus proteins possess the reproductive capacity and other properties characteristic of living organisms, as well as molecular features, any attempt at the present juncture to relegate them to one or other of these groups would be premature pending further experimental data.

ENDRIGKEIT (A.). **Beiträge zum ernährungsphysiologischen Problem der Mykorrhiza unter besonderer Berücksichtigung des Baues und der Funktion der Wurzel- und Pilzmembranen.** [Contributions to the nutritional-physiological problem of mycorrhiza with special reference to the structure and function of the root and fungus membranes.]—*Bot. Arch.*, xxxix, 1, pp. 1–87, 16 figs., 1937. [English summary.]

A comprehensive discussion, supplemented by a three-page bibliography, is given of the writer's studies at Königsberg and elsewhere in

East Prussia, on the nutritional and physiological aspects of mycorrhiza, on the basis of which these structures are divided into two groups, viz., endotrophic, represented by Liliaceous mycorrhiza of the *Allium* type, and ectotrophic, exemplified by that of *Pinus* [*R.A.M.*, xvii, p. 126].

It was shown by physico-chemical investigations of the root and fungus membranes and permeability experiments that endotrophic mycorrhiza are isolated by the early decaying rhizodermis and intercutis [hypoderm], which become suberized. The mycorrhiza of this group examined (*A. suaveolens*, *Convallaria*, and *Maianthemum*) showed little or no capacity for the absorption of stains in comparison with the autotrophic roots of various plants. A full account is given of the mode of penetration and development of the inter- and intracellular endotrophic mycorrhiza of *Molinia coerulea*. The influence of the intercutis in mycorrhiza of the *Allium* type increases parallel with a decline in the number of transfusion cells, the pits of which may be observed in *A. suaveolens*. The mycelium, isolated by the intercutis, maintains a connexion with the exterior by means of infection hyphae.

The disappearance of starch from the cells of the above-mentioned plants and of *Rhamnus frangula* colonized by endotrophic mycorrhiza was shown to be a reaction of the host to fungal infection. Whereas in non-infested roots the starch is deposited indiscriminately, in those colonized by mycorrhiza it preponderates in the cells free from mycelium. The intracellular arbuscles cannot be interpreted as assimilatory organs, since they are digested as they are formed and show no indication of hyphal development from their terminal branches, but rather as proliferations induced by the growth-promoting stimuli of the cell sap. The results of the permeability tests point to the direct transference to the plant of the substances mobilized by the fungus. This is exemplified by the migration of pigments from the hyphae into the cell walls or protoplasts of the host cells. The assimilation of nutrients from the associated fungus mycelium is also explicable on the basis of the theory of the transmission of the negative pressure in the vessels to the root parenchyma.

This exchange mechanism is of definite importance in the nutritional-physiological function of the ectotrophic forest tree mycorrhiza. The assimilatory capacity of the roots has been found to depend on the fungus mantle and the development of the 'Hartig net', the mycelium alone providing a connexion with the exterior. Whereas in conifers, e.g., *P. sylvestris*, the intercellular mycelium encircles the entire primary bark, in deciduous trees, such as lime and oak, the 'Hartig net' is confined to the radially extending rhizoderm. The opinions recently expressed as to the endophytic character of the ectotrophic forest tree mycorrhiza find no support in the writer's investigations. Fungal virulence varies in some degree with the incidence of root infestation without in any way altering the intercellular character of the relationship. No nutritional or physiological significance can be attributed to the occasional observation of rudimentary intracellular infection or the common intensification of the 'Hartig net' on a decayed primary cortex.

Since the parasitic acquisition of nutrients by the fungus is of a very restricted order in both mycorrhizal groups, the higher plant is evidently the chief gainer by the association until the activity of the roots begins

to decrease with age, when the balance inclines in favour of the fungus. Comparative membrane and permeability observations on plants in a colonized and uncolonized condition revealed a progressive loss of independent assimilatory capacity of the roots with increasing fungal activity.

The permeability experiments on auto- and mycotrophic plants disclosed exceptions to the rules hitherto held to govern the infiltration capacity of stains. Infiltration into the roots is dependent, not only on the solubility and particle size of the stain, but also on the membrane substance and root mechanism, which influence the mobility, velocity of absorption, and path of diffusion of the colouring matter through the cell membranes.

Kögl (F.). **On plant growth hormones.**—*J. Soc. chem. Ind., Lond.*, lvii, 3, pp. 49–54, 3 diags., 2 graphs, 1938.

In connexion with a general review of recent developments in the utilization of plant growth hormones in medicine, chemistry, and botany, the writer briefly summarizes the results of his experiments (in collaboration with N. Fries) on the application of biotin, inositol, and aneurin as stimulants to fungal growth [*R.A.M.*, xvii, p. 196].

Davidson (W. D.). **Potato growing for seed purposes.**—236 pp., 63 pl. (1 col.), 1 fig., Dublin, Stationery Office, [1937]. Price 2*s.* 6*d.*

This comprehensive and well-illustrated publication, a further revised and greatly enlarged version of a pamphlet with the same title published in Eire in 1925 and (in a revised form) in 1931, is intended for commercial growers of seed potatoes. Every aspect of the subject is covered, including cultivation, inspection and certification, marketing, diseases (the section on which (pp. 32–106) has been entirely rewritten), the production of healthy stocks, and the identification of varieties.

McLean (J. G.). **Fusarium avenaceum, a vascular parasite of Potato.**—Abs. in *Phytopathology*, xxviii, 1, p. 16, 1938.

Fusarium avenaceum, first observed on potatoes in Wisconsin in 1936 and since collected throughout the State, penetrates the roots and causes seed-piece decay. The tuber symptoms resemble those due to the more common wilts, *F. solani* var. *eumartii* and *F. oxysporum* [*R.A.M.*, xvi, p. 489], but the aerial organs of the plants are differently affected. There is a reduction of leaf area caused by the decrease in size of the leaflets on the apical leaves and an increase in the number of folioles. The axillary buds are stimulated to form secondary shoots or aerial tubers. Chlorosis and tipburn are typical, accompanied by stem and petiole rigidity. The leaves roll upwards and acquire a rough texture, while reddening or purpling of the tops is fairly common. The Cobbler, Triumph, Katahdin, and Rural varieties are susceptible to *F. avenaceum*, whereas early sorts tend to escape infection.

Spraing, internal rust spot, and net necrosis of the Potato tuber.—*Adv. Leafl. Minist. Agric. Fish., Lond.*, 290, 4 pp., 3 figs., 1938.

Spraing of potato [*R.A.M.*, xiii, p. 649; xvi, p. 514], which is not very common in England, is stated to occur on the Continent, especially in Holland, where the name 'concentric necrosis' has been suggested

for it [ibid., xiv, p. 253]; it has not been reported from other parts of the world. The evidence indicates that it may be a virus disease, contracted from the soil.

A special form of internal rust spot [ibid., xvi, p. 400], or possibly a different disease altogether, occurs in certain localities. In this form the spots may be scarcely perceptible at lifting, but develop subsequently, and often break down, with the result that cavities are formed and the tuber frequently decays.

Net necrosis [loc. cit.] is uncommon in Britain, but has recently become important in Scotland in Golden Wonder potatoes.

Ehrke [G.]. **Zur Eisenfleckigkeit der Kartoffeln. Wie verhalten sich eisenfleckige Kartoffeln im Winterlager und in welchem Masse wird der Pflanzgutwert der Kartoffeln herabgesetzt?** [On Potato 'Eisenfleckigkeit'. How do 'eisenfleckig' Potatoes behave in winter storage and in what degree is the value of the Potatoes for seed impaired?]—*Dtsch. landw. Pr.*, lxv, 2, pp. 15–16, 5 figs., 1938.

Except in extreme cases of the form of potato 'Eisenfleckigkeit' [*R.A.M.*, xv, p. 250; xvii, p. 198] known as 'Pfropfenbildung' [ibid., x, p. 746], there appears from the writer's experiments at Dahlem, Berlin, with the Sickingen, Rosafolia, and Erdgold varieties to be no risk either of an increase of the disorder itself or of the development of fungal or bacterial rots in affected material during winter storage. Tests with severely diseased Goldfink tubers further showed that the initial slight reduction of germination is purely temporary, and that the disease is not transmissible to the progeny in any of its various manifestations. The 'scattered' form of Eisenfleckigkeit seems from protracted observations to be restricted to certain soils in which a layer of mild humus is superimposed on gravel with a deep ground-water surface or on clay, and to occur only under a particular set of meteorological conditions.

Wenzl (H.). **Zur Histogenese der Braunmarkigkeit und Hohlherzigkeit der Kartoffelknollen.** [On the histogenesis of medullary browning and hollow heart of Potato tubers.]—*Phytopath. Z.*, x, 6, pp. 594–605, 6 figs., 1937.

A detailed account is given of the author's histological studies on the disorder of Böhm's Allerfrüheste Gelbe potato described by Rothmaler in Austria as heart necrosis [*R.A.M.*, xi, p. 534] for which the name medullary browning is preferred, hollow heart being the final development of the disorder. The material studied was obtained from a small plot of this variety growing on a light sandy soil at the Plant Protection Institute, Vienna. Of the 431 tubers examined, 32 per cent. showed marked symptoms of either medullary browning or hollow heart and a further 9 per cent. were mildly affected by the former. As remarked by previous workers, large tubers sustained heavier damage than those in the lighter weight classes (87·5 per cent. in the group weighing over 131 gm. as compared with 7 per cent. in the 20 to 30 gm. lot). Nearly 25 per cent. of the small tubers (30 to 50 gm.), however, were necrotic in the heart region, though otherwise perfectly sound.

As a result of his studies the author concludes that medullary browning and hollow heart in Böhm's Allerfrüheste Gelbe potatoes arise in consequence of enzymatic disorders manifested in the first place by starch breakdown and later by the death of individual cells or cell groups. No essential connexion could be detected between the rupture of cells or abnormalities in intercellular space formation and the abovementioned cellular necrosis, the attribution of which to 'histological tensions' is unacceptable. Such 'tensions' are only expressed, after the isolation of the necrotic area by a cork layer subsequently forming the wall of the cavity, in a rupture of the dead tissue or detachment of the newly erected cork wall, and are in any case not the cause, but the result of heart necrosis.

Black (L. M.). **A study of Potato yellow dwarf in New York.**—*Mem. Cornell agric. Exp. Sta.* 209, 23 pp., 4 pl., 2 maps, 1937.

After stating that potato yellow dwarf [*R.A.M.*, xv, p. 42; xvii, p. 132] has in recent years caused serious loss to the certified seed-potato industry in New York, the author describes how in the acute stage flowers are rarely present, the top of the plant being killed before blossoms develop. The symptoms of this stage on an inflorescence include dwarfing of all the parts, failure of the flowers to open, water-soaked zones on the petals, and necrosis of the petals and sepals. In the chronic stage, vines from badly affected tubers are dwarfed and spindling. The chronic stage is not usual on plants in the field, but inoculated plants grown at 27° to 33° C. in the greenhouse generally show the acute symptoms in the primary axis, and the chronic symptoms in the axillary branches that develop afterwards. This new growth quickly outgrows its initial tendency to form rosettes of leaves. The apical meristem continues to grow, instead of dying, as in the acute stage. Dwarfed leaves showing vein-clearing and mild mottle are produced, whereas in the acute stage the uppermost leaves turn yellow and die. The internal apical necrosis characteristic of the beginning of the disease may be almost unnoticeable in the chronic stage, in which a short, superficial, depressed streak is generally present instead, directly below the leaf axils on the lower part of the stem, and often extending along the lower surface of the petiole; later, the affected leaves die and fall off. The tubers show less necrotic spotting than in the first stage. The change from the acute to the chronic stage is a regular process in the development of the disease, and is not caused by special environmental conditions inducing masking. Infected plants grown for five vegetative generations showed no further improvement, a state of equilibrium having, apparently, been reached between virus and plant. Scions from plants in the chronic stage induced symptoms of the acute stage on grafted test plants, indicating that the virus is present in plants in the chronic stage but that its pathogenic activity has become reduced as a result of some change in the plants.

Transmission tests with *Myzus persicae* all gave negative results, two shipments of the Wisconsin collection of *M. persicae* used by Koch (1934) also failing to transmit the virus [ibid., xiv, p. 190]. The evidence obtained further indicated that *Empoasca fabae*, *Macrosiphum solanifolii* [ibid., xv, p. 43], *M. pseudosolani*, *Deltocephalus inimicus*,

Phenacoccus gossypii, *Pseudococcus citri*, *Lygus pratensis*, and the potato flea-beetle [*Epitrix cucumeris*] are not vectors. The clover leaf-hopper (*Aceratagallia sanguinolenta*) [loc. cit.], on the other hand, was proved to transmit the virus. This insect, which occurs throughout the United States, except on the Pacific slope, is found in potato fields from the emergence of the sprouts until the death of the vines. It can overwinter the virus in its body, and may be viruliferous at any season.

Trifolium pratense, *T. hybridum*, *T. repens*, and *T. agrarium* are susceptible to the disease, the first-named probably being an important source of the virus, which was also transferred to 17 potato seedling varieties raised by the United States Department of Agriculture and 6 wild species of potato, as well as Marglobe tomatoes, *Physalis heterophylla*, and *Hyoscyamus niger*.

Seed-potato plots should be isolated both from diseased clover and diseased potatoes, and tubers from fields where new infections have developed at the edges in August should be tested before being used for seed by growing or slicing a sample to ascertain the extent of infection. Roguing was unavailing where spread was taking place rapidly, and precautions against spread from the cutting knife were found to be unnecessary. No control results from selecting either large or small potatoes for planting.

WALKER (J. C.) & LARSON (R. H.). **Soil temperature in relation to Potato yellow dwarf.**—Abs. in *Phytopathology*, xxviii, 1, p. 21, 1938.

Epidemics of potato yellow dwarf [see preceding abstract] in central Wisconsin have been characterized by poor stands rather than high percentages of plants with systemic symptoms. The major crop is often exposed to high temperatures in the light, sandy local soils during and immediately after planting in the first half of June. Experiments were conducted in soil held at constant temperatures of 16°, 20°, 24°, and 28° C., with a common atmospheric temperature of 20° to 22°, infected tubers being cut into four pieces and one piece planted at each temperature. At 16° germination and development were normal, at 20° emergence was normal, but the plants were slightly dwarfed, at 24° emergence was reduced and severe symptoms developed, while at 28° there was practically no emergence. Seed pieces in non-emerging hills usually remain firm for several weeks, often until the harvest, and even later they commonly germinate normally in cool soil.

MATZULEVITCH (B. P.) & VEREVITCHEVA (Mme L. V.). Оценка серологического метода в определении зараженности клубней Картофеля вирусами. [The serological method as a means of determining the infection of Potato tubers by virus diseases.]—*Pl. Prot., Leningr., 1937*, 14, pp. 91–95, 1937.

The authors compare the biological and serological methods of determination of infection of potato tubers with rugose and streak mosaics [*R.A.M.*, xvii, p. 126] in the following experiments. One half of the material, consisting of diseased and healthy specimens from the Kruger [President], Great Scot, Lorch, Seyanetz, Waltman, Deodara, Epicure, Triumph, SAS, and Orig. Gisevius potato varieties, was planted and observed in hothouses; the other half was reserved for

serological analysis. Antigens were prepared from both diseased and healthy tubers, and were used undiluted for the precipitation reactions. The antiserum of the rugose mosaic virus had a titre of 1:2,500, and that of the streak mosaic virus 1:12,800. The control serum was obtained from rabbits inoculated with the sap of healthy potato tubers and was used in the following dilutions: 1:20, 1:40, 1:80, 1:160, 1:320, 1:640, and 1:1,280. The comparison of the two methods showed an agreement of 81·5 per cent. in results with the rugose mosaic virus and 85 per cent. in those with streak mosaic. The serological method being the quicker of the two can be recommended as supplementary to the biological. It has also the advantage of being independent of the growing season.

Clark (C. F.). **Recent developments in Potato breeding: review of literature.**—*Amer. Potato J.*, xv, 1, pp. 16–22, 24, 1938.

Most of the papers cited in this survey relating to the phytopathological aspects of potato breeding (1936–7) have been noticed from time to time in this *Review*, but the following item may be mentioned. Studies by E. K. Emme in the U.S.S.R. (*Biol. Zh.*, v, p. 901, 1936) showed that all the triploid hybrids derived from crosses between *Solanum rybinii* and (*a*) two varieties of *S. antipoviczii* (*grandarae* and *reddickii*) and (*b*) *S. ajuscoense* var. *candelarianum*, all having haploid chromosome numbers of 24, were resistant to late blight (*Phytophthora infestans*) and virus diseases [*R.A.M.*, xvii, pp. 131, 200, 267].

Böning (K.) & Wallner (F.). **Beobachtungen und Versuche zur Frage der Widerstandsfähigkeit der Kartoffelsorten gegen Schorf.** [Observations and experiments in connexion with the problem of varietal resistance of Potatoes to scab.]—*Prakt. Bl. Pflanzenb.*, xv, 8–9, pp. 268–279, 2 figs., 1938.

Of a number of German potato varieties reputedly immune from scab (*Actinomyces*) [*scabies*] or more or less resistant to the disease [*R.A.M.*, xvii, pp. 132, 198], grown from 1935 to 1937 in quadruplicate test plots in various types of sandy soil where infection is particularly prevalent in Bavaria, only Jubel, with the possible additions of Treff As and Edelragis, gave moderately satisfactory results in this respect under local conditions. Realizing that the varietal susceptibility data obtained in one district are not necessarily applicable to other parts of the country, the writers suggest that scab reaction trials should be conducted in different localities throughout Germany. In a test at Donaumoos in 1936, Flava, Erdgold, Treff As, Parnassia, Ackersegen, Altgold, Voran, and Mittelfrühe were much more resistant than Allerfrüheste Gelbe, Goldwährung, Industrie, Ovalgelbe, and Goldgelbe.

The incidence of potato scab depends largely on the weather, and was much higher in the exceptionally dry summers of 1935 and 1937 than in 1936. The disease generally predominates on light sandy soils, but anomalous results were obtained in some of the tests to determine the influence of soil constitution on scab development, which was unexpectedly abundant, for instance, on certain moorland soils with a strongly alkaline reaction (P_H 7·5 to 8).

Opinions differ as to the relative importance of the several *A.* strains

implicated in the disease and of specific varietal tendencies in the production of flat or protuberant scab. In the writers' tests, the same variety under exactly comparable conditions may exhibit both forms, while other varieties develop exclusively one or the other type on different soils.

In 1936 powdery scab (*Spongospora subterranea*) [ibid., xvi, p. 274] assumed such a virulent form, especially on the Aal, Ackersegen, Erdgold, Robinia, and Treff As varieties, that common scab attracted no attention. A degree of control was achieved in tests with the relatively resistant Parnassia by the incorporation with the ordinary fertilizer of sulphur dust at the rate of 400 kg. per hect., which reduced the incidence of infection from 26 to 17 per cent.

MOORE (A.). **Rubber-growing: elementary principles and practice.**—*Plant. Manual Rubb. Res. Inst. Malaya* 7, 82 pp., 24 pl., 3 figs., 3 diags., 1938.

This manual includes several chapters (pp. 49–74) on the symptoms and control of fungous diseases of rubber (*Hevea brasiliensis*). There is also a chapter on disinfectants and fungicides.

SCHWEIZER (J.). **Over een physiologische theorie van de bruine binnenbast-ziekte bij Hevea brasiliensis.** [On a physiological theory of the brown bast disease of *Hevea brasiliensis*.]—*Bergcultures*, xii, 2, pp. 31–39, 2 graphs, 1938.

Chemical analyses have shown that the latex of brown bast-diseased rubber trees in Java [*R.A.M.*, xvii, p. 343] has an abnormally high ash and low nitrogen content in comparison with healthy material, whence it may be inferred that in the former case the rubber globules have assimilated less albumin and more mineral constituents than in the latter. From a colloid-chemical standpoint the normal lyophilia of the latex has been converted into lyophobia. The latex of diseased trees shows a very pronounced tendency to self-coagulation in a glass cylinder. The composition of the latex of affected trees was further shown to be completely altered, the rubber concentration having sunk to less than half, whereas the cations, especially magnesium, were increased, and calcium was virtually absent. These results indicate that a partial loss of semi-permeability of the cell wall, which normally allows the passage of water while retaining salts and other dissolved substances, is involved in the development of the disease.

BEELEY (F.). **Oidium heveae. Report on the 1937 outbreak of Hevea leaf mildew.**—*J. Rubb. Res. Inst. Malaya,* viii, 2, pp. 140–148, 1 graph, 1938.

The general improvement in foliage of *Hevea* rubber trees recorded in the previous year's report [*R.A.M.*, xvi, p. 61] was maintained in 1937 in Malaya generally, with the exception of the central part of Selangor. Dry weather at the end of 1936 and the beginning of 1937 created conditions unfavourable to an epidemic of mildew (*Oidium heveae*). The sulphur-dusting programmes were reduced to one or two rounds of dusting or omitted altogether. Sulphur-dusting is gaining in

popularity and will, no doubt, soon be considered an essential method of control against *O. heveae* and other leaf parasites.

HANSFORD (C. G.). **Annotated host list of Uganda parasitic fungi and plant diseases. Part V.**—*E. Afr. agric. J.*, iii, 4, pp. 319–324, 1938.

This further contribution to the author's list of parasitic fungi and plant diseases in Uganda [*R.A.M.*, xvii, p. 345] comprises diseases of 16 families of plant hosts and also of insects and nematodes.

HANSFORD (C. G.). **Contributions towards the fungus flora of Uganda. I. The Meliolineae of Uganda.**—*J. linn. Soc.* (*Bot.*), li, 339, pp. 265–284, 1937.

This is a critically annotated list of 68 Meliolineae collected by the author in Uganda, including 35 new species and 5 new varieties [with Latin diagnoses] erected in part in collaboration with the late F. L. Stevens.

UNAMUNO (L. M.). **Notas micológicas. XIII. Nuevos datos para el estudio de los hongos imperfectos de la flora española.** [New data for the study of the fungi imperfecti of the Spanish flora.]—*Bol. Soc. esp. Hist. nat.*, xxxvii, 1–6, pp. 65–77, 7 figs., 1937. [Received April, 1938.]

In continuation of his geographical and taxonomic studies on the Spanish mycoflora [*R.A.M.*, xv, p. 529], the writer gives an annotated list of 36 fungi imperfecti from various parts of the country.

ARWIDSSON (T.). **Über Asterocytis, Astrocystis und Asterocystis.** [On *Asterocytis*, *Astrocystis*, and *Asterocystis*.]—*Bot. Notiser*, *1938*, 1–3, pp. 190–192, 1938.

Confusion having arisen between the genera *Asterocytis*, *Astrocystis*, and *Asterocystis*, the writer elucidates the position as follows. *Asterocytis* Gobi is a genus of algae; *Astrocystis* B. & Br. (Sphaeriaceae) and *Asterocystis* de Wildem. (Oomycetes) are merely orthographic variants of the same name, one of which, according to article 40 of the Rules of Botanical Nomenclature, must be discarded. In the case in point, *Astrocystis*, dating from 1873, obviously takes precedence of *Asterocystis* (1894), which should be replaced by *Olpidiaster* Pascher 1917 (*Beih. bot. Zbl.*, xxxv, p. 578) [but see *R.A.M.*, xvi, p. 775].

BOEDIJN (K. B.). **A smut causing galls on the leaves of Hypolytrum.**—*Bull. Jard. bot. Buitenz.*, Sér. 3, xiv, 3–4, pp. 368–372, 2 figs., 1937.

Latin and English diagnoses are given of *Cintractiella lamii* Boedijn n.g., n.sp., found parasitizing the leaves of *Hypolytrum* sp. (Cyperaceae) in New Guinea in 1920. On the under side of the leaves are formed bundles of flattened, straight, or slightly curved shoots, $\frac{1}{2}$ to 2 cm. by 1 to $1\frac{1}{2}$ mm., consisting of a short stem entirely covered with pale green, scale-like leaves, from the apices of which project hard, black, cylindrical sori, 8 to 12 by $\frac{1}{2}$ to $\frac{3}{4}$ mm., composed of agglutinated spores and enveloped by a thin layer of hyaline hyphae; the globose, thick-walled, brown, reticulate spores measure 29 to 36 μ in diameter and are

furnished with germ pores 2 to 3 μ long. The intercellular mycelium is provided with numerous coiled, lobed, often branched haustoria.

Cintractiella resembles *Cintractia* in its agglutinated spores and in its parasitizing a member of the Cyperaceae, but differs from it in its formation of peculiar galls and in its large spores with germ pores.

Van der Meer Mohr (J. C.). **Verslag van het Deli Proefstation over het jaar 1936.** [Report of the Deli Experiment Station for the year 1936.]—*Meded. Deli-Proefst.*, Ser. 2, xlvii, 51 pp., 1 diag., 1937.

The following items of phytopathological interest occur in the botanical (H. G. van der Weij) and agricultural (J. van der Poel) sections of this report [cf. *R.A.M.*, xv, p. 686]. The form of tobacco mosaic known as 'daon lidah' assumed a great variety of aspects in 1936, including the development of tongue-shaped leaves, with and without mottling; mottling in only some of the leaves of a plant; stunted growth and a reduction of the entire leaf surface, verging in extreme cases on the 'cabbage-tobacco' type; the foregoing symptoms combined with mosaic; necrotic leaf spots of various shapes; and transitional stages approximating to certain forms of 'gilah' or 'kroepoek' [identical in part with leaf curl: ibid., xvii, p. 75].

A number of *Nicotiana triplex* plants raised from seed in connexion with a cytological investigation showed some degree of resistance to leaf spot [*Cercospora nicotianae*: ibid., xvi, p. 414] in comparison with other Deli selections.

Full details are given of the progress of an extensive series of experiments in the control of slime disease [*Bacterium solanacearum*: ibid., xvi, p. 780] by various fertilizers.

Holmes (F. O.). **Taxonomic relationships of plants susceptible to infection by Tobacco-mosaic virus.**—*Phytopathology*, xxviii, 1, pp. 58–66, 1 diag., 1938.

Of 73 species of herbaceous dicotyledons tested for their reaction to tobacco mosaic at the Rockefeller Institute for Medical Research, Princeton, New Jersey, 46 proved susceptible to infection by the virus, which was shown to increase in inoculated leaves by quantitative subinoculation tests and observation of symptoms at the site of inoculation. The results showed that a correlation appears to exist between susceptibility to mosaic and the conventional system of taxonomic classification, since nearly all the tested plants in one group of 11 families lacked the capacity to support increase of the virus, which was tolerated, on the other hand, by 95 per cent. of the species in another group of 14 families.

Thornberry (H. H.). **Crystallization of Tobacco-mosaic virus protein.** —*Science*, N.S., lxxxvii, 2248, pp. 91–92, 1938.

The writer describes in detail a method for the crystallization of tobacco mosaic protein involving the heating of the macerated frozen tissue to 40° C., adjusting the reaction to about P_H 7 by adding disodium phosphate, and clarifying the juice by filtration. Further crystallization is effected by adjusting the reaction to P_H 4·5 with acetic

or sulphuric acid, salting out with ammonium sulphate, and storage at 0° to 5° C. overnight.

FRANKE (H. M.). **Toxisches Agens und lokale Resistenz beim klassischen Tabak-Mosaik-Virus.** [The toxic principle and local resistance in the ordinary Tobacco mosaic virus.]—*Planta*, xxvii, 4, pp. 392–398, 4 figs., 1937.

Local resistance to the ordinary tobacco mosaic virus in *Nicotiana glutinosa* and *Datura stramonium* [*R.A.M.*, xvii, p. 272] was found to be associated with the possession of specific 'immunity buffer systems', the reaction of which to the virus leads to the elaboration at the site of infection of toxic, necrosis-inducing principles. By grafting susceptible plants (tomato and tobacco) on locally resistant individuals, the immunity principles are transferred to the susceptible scions, which subsequently react to infection by the production of local necroses. The virus inactivation accompanying the necrosis induced by the reaction of the immunity principles represents a specific defensive mechanism in the locally resistant plants.

HOLMES (F. O.). **Strain of Tobacco resistant to Tobacco mosaic.**—Abs. in *Phytopathology*, xxviii, 1, p. 9, 1938.

A dominant gene, inducing a necrotic type of reaction to infection by the tobacco mosaic virus [*R.A.M.*, xvii, p. 349; and next abstract] was transferred from *Nicotiana glutinosa* to *N. tabacum* by intermediate crossing with the amphidiploid species *N. digluta*. After hybridization, successive back-crosses to *N. tabacum*, combined with the selection of necrotic-type individuals, produced *tabacum*-like plants, which responded to infection by symptoms typical of *N. glutinosa*. Repeated self-pollinations gave rise to wholly necrotic-type strains of tobacco. The presence of the gene conferring the necrotic type of reaction makes the transfer of virus from diseased plants more difficult, and it is thought that the infective principle will be unable to survive in the field in tobacco plants containing this gene.

NOLLA (J. A. B.). **Inheritance in Nicotiana. III. A study of the character for mosaic resistance in Nicotiana tabacum L.**—*J. Hered.*, xxix, 1, pp. 43–48, 3 figs., 1938.

In continuation of previous studies on the inheritance of mosaic resistance in tobacco [*R.A.M.*, xiv, p. 660, and preceding abstract] the author discusses the results obtained from crossing the mosaic (Johnson's tobacco virus 1)-resistant Ambalema variety of *Nicotiana tabacum* with some susceptible varieties, such as Turkish (Samsun) (T), White Virginia No. 9, and No. 144–9–1, a line resistant to *Phytophthora* [*parasitica nicotianae*] isolated from the cross Cuban × Turkish. The behaviour of the F_1 generation of the direct and reciprocal cross Ambalema × Turkish indicated that susceptibility to tobacco mosaic is dominant over resistance. The results in the F_2 and F_3 generations of various other crosses, with back-crosses to Ambalema, show that duplicate factors are involved, recessiveness of the two factors producing resistance to mosaic whereas susceptibility results when either factor or both are dominant. The evidence from F_2, F_3, and back-cross generations

indicates that there is a 15 to 1 ratio of susceptibility to resistance in the progeny of the Ambalema × Turkish cross.

Clayton (E. E.), Smith (H. H.), & Foster (H. H.). **Mosaic resistance in Nicotiana tabacum.**—Abs. in *Phytopathology*, xxviii, 1, p. 5, 1938.

Tobacco seed collections from Mexico and Central and South America were tested for resistance to common mosaic [see preceding abstracts]. Of the 897 lots examined, 36 proved to be resistant, all from Colombia, South America. Included in this group were a number of varieties quite distinct from Ambalema. The resistant collections fell into two categories, the highly resistant showing from none to many localized pale green spots, and the moderately resistant exhibiting mild systemic mottling. The resistance reaction of the former group (which includes Ambalema) was found to be conditioned by two major recessive factors, possibly subject to some degree of modification by other factors.

Allison (C. C.). **Physiologic specialization of Thielaviopsis basicola on Tobacco.**—Abs. in *Phytopathology*, xxviii, 1, p. 1, 1938.

Four distinct physiologic races of *Thielaviopsis basicola* were differentiated on the basis of their pathogenicity to the four tobacco varieties Special 400, Kentucky Nos. 5 and 16, and Harrow's Velvet [*R.A.M.*, xvi, p. 637] sown in plots on artificially infected soil. Kentucky 5 was moderately susceptible to race 1, to which the other varieties were resistant; Kentucky 5 and Special 400 were moderately susceptible to race 2, Kentucky 16 and Harrow's Velvet being resistant. Kentucky 5 and Special 400 were susceptible, Kentucky 16 fairly so, and Harrow's Velvet resistant to race 3. Harrow's Velvet was moderately susceptible to race 4, which severely attacked the other three varieties. Races 1 and 2 were isolated from black root rot material obtained from Tennessee and North Carolina, 3 from plants originating in Tennessee and Washington, D.C., and 4 from specimens sent from Wisconsin and Canada.

Grampoloff (A. V.). **L'action des rayons ultra-violets sur l'entreposage des denrées périssables.** [The action of ultra-violet rays on perishable commodities in storage.]—*Annu. agric. Suisse*, li, 10, pp. 1130–1158, 1 col. pl., 5 figs., 11 graphs, 1937. [German summary.]

Further experiments at Wädenswil, Switzerland, on the control of storage rots of tomatoes (Tuckswood, Ailsa Craig, and Westlandia) of local and Canary origin by daily discontinuous (1 min. 10 secs. to 2 min. 54 secs.) and continuous (5 to 10 min.) exposure to ultra-violet irradiation [*R.A.M.*, xvi, p. 135] gave moderately satisfactory results at 4° and 8° C. (15° in the case of green fruit). The process effected a general reduction in the extent of the losses due to decay, though certain fungi offered considerable resistance to penetration by the rays, mycelial growth in the interior of the fruits being particularly difficult to suppress. The fungi principally involved in the decay of the Swiss material at 0° C. and 85 per cent. relative humidity were *Botrytis cinerea* and *Cladosporium lycopersici*, green fruits at higher temperatures being chiefly attacked by *Macrosporium* [*Alternaria*] *tomato*. The Canary tomatoes were infected by *A.* sp., *Phoma destructiva*, *B. cinerea*, *Penicil-*

lium glaucum, *Fusarium erubescens* [*F. scirpi* var. *acuminatum*: ibid., xvi, p. 323; xvii, p. 154], and occasionally by *C. lycopersici*. The flavour of the fruits was not impaired by irradiation, which did, however, impede the natural spread of the red coloration. The daily cost of the treatment (2 min. 54 secs. for each tomato) is estimated at fr. 0·15 per 100 kg., the corresponding figure for 10 minutes' irradiation being fr. 0·51 per 100 kg.

YOUNG (P. A.) & TAUBENHAUS (J. J.). **Weighted percentages of resistance of Tomato varieties to Fusarium lycopersici.**—Abs. in *Phytopathology*, xxviii, 1, pp. 22–23, 1938.

In extensive field tests of the reaction of tomato varieties to wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) [*R.A.M.*, xvii, p. 354] under epidemic conditions, 70 to 91 per cent. resistance was manifested by Sureset Forcing, Michigan State, Marglobe, Rutgers, Guba's crosses 421 and 424, Marvel, Blair Forcing, Louisiana Red, Kanora, Buckeye State, Marvana, Marglobe 75, Norduke, Louisiana Pink, and Marglobe 63. A number of varieties of low and intermediate resistance are also listed.

ALEXANDER (L. J.). **A new Tomato variety resistant to leaf mold.**—Abs. in *Phytopathology*, xxviii, 1, p. 1, 1938.

The new tomato variety, Globelle, resistant to leaf mould [*Cladosporium fulvum*: *R.A.M.*, xv, p. 470] is the result of a breeding programme carried through 14 generations since its inception in 1930. The parents of the original cross were Globe and Red Currant (*Lycopersicum pimpinellifolium*). Four additional crosses to the type varieties, Globe and Marhio, were necessary, and six generations have elapsed since the last cross. The growth habits of Globelle generally resemble those of Globe, but the quality of the fruit is superior. What appeared to be a semi-lethal factor was observed in the F_2 generation of the original cross and subsequently shown to be linked with the Cf_{p1} resistant factor, between which and small fruit size linkage was also established. In 1937 occasional leaf mould lesions were detected on heavily fruiting plants even of resistant lines, while Globe in the same test was almost completely defoliated and consequently produced small, low-grade fruits.

SPAULDING (P.). **A suggested method of converting some heavily Nectria-cankered hardwood stands of northern New England to soft-woods.**—*J. For.*, xxxvi, 1, p. 72, 1938.

Nectria canker is stated to be so destructive in numerous hardwood pole forest areas of northern New England that partial or complete conversion to softwoods appears to be the sole method of improving such stands for timber production. The following line of approach to the problem is suggested: (1) the release of properly spaced trees in the natural softwood reproduction already on the ground; (2) planting groups of 50 or more four-year-old red [*Picea rubra*], white [*P. glauca*], or Norway spruce [*P. abies*] at intervals where natural regeneration is lacking. About 25 years from the inception of these measures natural seeding should be in progress over the entire area concerned.

SCHMIDT (R.). **Mischpflanzung als Schädlingsbekämpfungsmittel.** [Mixed planting as a measure for disease control.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 3, pp. 32, 1 fig., 1938.

In connexion with the recommendation of mixed plantings as a measure of disease control in herbaceous cultures [see above, p. 398], attention is drawn to the benefits that have already been derived from a similar course in tree nurseries in Germany. The alternation of pyramid poplars [*Populus pyramidalis*] with weeping willows [*Salix babylonica*] has largely eliminated the prevalent willow scab [*Physalospora miyabeana*: *R.A.M.*, xv, p. 74], the spores of which presumably become lodged in the dense poplar foliage. The growth habit of both trees is also improved by the association.

MILLER (P. W.). **Studies on Walnut blight and its control in Oregon: seventh report of progress.**—*Rep. Ore. St. hort. Soc., 1937*, pp. 119–143, 1938.

In further spraying tests against walnut blight [*Bacterium juglandis*: *R.A.M.*, xvi, p. 425] carried out in Oregon in 1937, when the disease was moderately severe as a result of prolonged rains during the critical period of infection, almost as good control was given by Bordeaux mixture 2–2–50, 2–1–50, and 2–½–50, as by the 4–2–50 and 4–4–50 concentrations, though a concentration of 8–5–50 gave the best results. Foliage injury was generally reduced to an insignificant amount by the addition of fish or mineral oils or oil emulsions, and mixtures made with dolomitic or high-magnesium lime were less injurious than those made with high-calcium lime. Injury diminished with decreasing amounts of lime until the neutral point was reached. Preliminary studies indicated that Bordeaux mixture has less effect on the transpiration of walnut leaves than on that of some other plants. Copper oxalate (2–50) was at least as effective as Bordeaux mixture (2–1–50) and caused no perceptible foliage injury, while copper oxychloride (containing 40 per cent. metallic copper, and used at the rate of 2 in 50) was nearly as effective, and also caused no leaf injury.

MILLER (P. W.) & SCHUSTER (C. E.). **The causes and prevention of tree losses in young Filbert orchards.**—*Rep. Ore. St. hort. Soc., 1937*, pp. 191–196, 1938.

There is much evidence indicating that in Oregon and its vicinity young filbert trees [*Corylus avellana*] are predisposed to attack by the bacterial blight due to an organism very closely resembling *Phytomonas* [*Bacterium*] *juglandis* [see preceding abstract] by unfavourable factors such as winter injury, drought, and improper drainage. The trees should be sprayed with Bordeaux mixture (4–2–50) about the middle of August to prevent infection of the buds during the ensuing winter. Suckering and pruning should be deferred until late spring or early summer, when the critical period for infection is largely over, as wounds made in winter and early spring do not heal readily, and the bacteria may effect entry through them. Tools should be sterilized after use on each tree, especially when pruning and suckering trees two to four years old, infections in the trunks of which frequently result in fatal girdling.

JENKINS (ANNA E.) & BITANCOURT (A. A.). **An Elsinoe causing an anthracnose on Hicoria pecan.**—*Phytopathology*, xxviii, 1, pp. 75–78, 2 figs., 1938.

English and Latin diagnoses are given of *Elsinoe randii* n.sp., the causal organism of pecan anthracnose in São Paulo, Brazil. The fungus produces cinereous areas, sometimes purplish- to black-edged, on the upper leaf surfaces, and round or irregular spots, 0·5 to 5 mm. in diameter, outlining the midrib and veins or occupying the interveinal regions of the leaflet. The epiphyllous, round, oval, or irregular, pulvinate, dark brown to black ascomata, 80 to 200 μ in breadth, 50 to 120 μ in thickness, with hyaline, light brown pseudoparenchyma contain scattered or crowded, embedded, globose to ovate asci 14 to 21 μ in diameter, with 4 to 8 hyaline, triseptate ascospores, 6 to 8 by 11 to 16 μ. The imperfect (*Sphaceloma*) stage is characterized by round or irregular, yellow, brown, or black acervuli, up to between 50 and 150 μ in diameter, dark, densely aggregated conidiophores, 15 to 50 μ in thickness, and hyaline, continuous or uniseptate conidia, 8 to 15 by 4 to 5 μ (in culture).

BRAMBLE (W. C.). **Effect of Endothia parasitica on conduction.**—*Amer. J. Bot.*, xxv, 1, pp. 61–65, 1 fig., 2 graphs, 1937.

Experimental evidence showed that in chestnut stems from sprouts and seedlings artificially inoculated with *Endothia parasitica* [*R.A.M.*, xvi, p. 730] complete stoppage of water conduction occurs before the death of the foliage. This stoppage was noted only in those portions that bore bark lesions. The direct cause of the stoppage is considered to be most probably an abnormal formation of tyloses in the sapwood, which block the passage of water through the stem. Such mechanical blocking is regarded as the chief cause of the wilting and drying-up of leaves on infected chestnut stems.

VINES (A. E.) & CAMPBELL (A. H.). **A physiological effect of Lophodermium macrosporum on the needles of Picea excelsa.**—*Rep. Brit. Ass., 1937*, p. 423, 1937.

Spruce needles infected by *Lophodermium macrosporum* [*R.A.M.*, xv, p. 411] are not readily detachable even after the shoot has been cut from the tree for several months, denoting an interruption in the functioning of the abscission mechanism situated between the needle and the peg. The operation of this mechanism has been shown to be dependent upon considerable and rapid loss of water from the needle, which is prevented, in the case of infection by *L. macrosporum*, by the thick, black zone of fungal cells surrounding the base and the mycelial aggregations (sclerotia) occluding the stomata.

RAYNER (M. C[HEVELEY]). **The mycorrhizal habit in Pinus: a comment.**—*Forestry*, xi, 2, pp. 117–121, 1937.

In this critical discussion of Hatch's recent paper on ectotrophic mycorrhiza [*R.A.M.*, xvii, p. 126], with special reference to her own work on the subject [ibid., xv, p. 737], the author points out that Hatch does not clearly define his views on the nitrogen theory. There is, for instance, some doubt as to whether the greater acquisition of nitrogen by the mycorrhizal seedlings in Hatch's prairie soil experiment is related

solely with the more efficient absorption of nitrates, and his claim that peptone and nucleic acid can be absorbed directly by the roots of pine seedlings is not discussed from this point of view.

The author agrees in general with Melin's views [ibid., v, p. 246], with sufficient acceptance of Stahl's hypothesis to cover all soil types in which mycorrhiza are freely formed, and in this respect takes strong exception to Hatch's statement that her researches were 'planned from the viewpoint of the nitrogen theory'. They were in fact planned principally to give experimental proof of the 'critical importance of mycorrhiza normal for the species in the nutrition of young trees', and her statement that seedlings already present in the area concerned appeared to be chronically starved of nitrogenous constituents was not meant to exclude the probability of deficient supplies of other essential nutrients. The experiments served to confirm the circumstantial evidence already in existence that there is a direct causal relation between normal mycorrhizal development and healthy growth. Finally, Hatch offers no comment on the author's experiments with organic composts described in her second paper of 1936, though this was published nearly a year before Hatch's work.

Hahn (G. G.) & Ayers (T. T.). **Failure of Dasyscypha willkommii and related large-spore species to parasitize Douglas Fir.**—*Phytopathology*, xxviii, 1, pp. 50–57, 1 fig., 1938.

Artificial inoculations and field observations indicate that, under United States conditions, the European larch canker parasite, *Dasyscypha willkommii*, does not grow either parasitically or saprophytically on the blue form [var. *glauca*] of Douglas fir (*Pseudotsuga taxifolia*) [*R.A.M.*, xvi, p. 220]. *D. calycina* and *D. oblongospora* have occasionally been found fruiting on dead Douglas fir branches in the area of Massachusetts where *D. willkommii* was originally detected in 1927 on imported European larch [ibid., vii, p. 285], and were induced to grow on dying, but not on healthy, living, tissues of *P. taxifolia*. The morphological characters of artificially produced apothecia of *D. calycina* and *D. oblongospora* were identical with those described for the same organs occurring in nature. Another member of the large-spored group, the native *D. occidentalis*, has also not been observed on Douglas fir in nature and failed to grow in inoculation experiments.

True (R. P.). **Gall development on Pinus sylvestris attacked by the Woodgate Peridermium, and morphology of the parasite.**—*Phytopathology*, xxviii, 1, pp. 24–49, 3 pl., 6 figs., 1938.

The life-cycle of the Woodgate rust (*Peridermium* sp.) of *Pinus sylvestris* [*R.A.M.*, xv, p. 124] was followed histologically from the penetration of the epidermis of the current season's shoot by aecidial germ-tubes, through gall formation, to the production of pycnidia two years after penetration, and the repeated formation of aecidia in the ensuing season. In addition to naturally infected material available for examination, 140 inoculations were made on 27 trees, 9 to 30 years old, situated in the affected area near Woodgate, New York, from 1930 to 1933, during which period susceptibility was found to reach a climax in the first half of June.

The wide variety of initial response of single susceptible twigs to invasion indicates the existence of more than one physiologic race of the rust. Mycelia causing little early abnormality in the invaded tissues are considered to be compatible with the host. Incompatible mycelia induce the production of starches, fatty substances, and tannin-like compounds in the host cells adjoining the hyphae, which eventually die, together with the rust. The more compatible mycelia advance beyond this necrotic area and succeed in forming galls, but cellular hypertrophy, hyperplasia, and barrier erection often impede their passage through the cortex. Compatible mycelia invade the matured secondary tissues by the end of the first season, causing little structural change, while others may be delayed. Phloem and xylem are invaded mostly along the medullary rays. The presence of the fungus in the cambium causes the formation of abnormal secondary tissues of both phloem and xylem, both regions undergoing an increase in the size of the cells and the latter also in their number. Irregularities in the size, shape, and pitting of the tracheids may also be observed. Starches, fatty substances, and tannins are laid down both in the mature stelar parenchyma and in the abnormal secondary tissues. During the third season of infection the starch and fats in the affected parenchymatous xylem tissues are replaced by tannin-like compounds, causing the cessation of conduction and sometimes resulting in the death of the branch beyond the gall. Meanwhile, the death of the inner cortical and abnormal phloem cells cuts off the external portions of the cortex from radial conduction, leading to necrosis, collapse, and subsequent exfoliation of these portions, except at the edges, where they remain as a raised collar.

Early in May, two-year-old galls frequently bear pycnidia concealed immediately beneath the periderm below the sunken central área, this being the first report of these organs for the Woodgate rust. Three-year-old galls frequently produce confluent aecidia from extensive dense mycelial wefts in the depressed region developing just below the place of the exfoliated pycnidia. Each year the tissues containing the aecidial weft are exfoliated by a periderm arising internal to them, and the next year aecidia are formed below the new periderm.

A comparison of ash analyses of two- and four-year-old galls with those of uninfected portions of susceptible trees showed the galls to be significantly lower in silicon and higher in nitrogen, phosphorus, and sulphur contents.

Preliminary cytological studies demonstrated the cells of the perennial vegetative mycelium to be predominantly uninuclear. Two, three, and rarely four nuclei appear in the cells at the base of the aecidial chain, the young aecidiospores, and many parts of the germ-tubes, but the last named are mainly uninucleate when they enter the host.

Campbell (W. A.). **The cultural characteristics of the species of Fomes.** —*Bull. Torrey bot. Cl.*, lxv, 1, pp. 31–69, 128 figs., 1938.

The studies reported in detail in this paper were undertaken for the primary purpose of working out a practical system for the rapid identification of wood-destroying fungi in pure culture, and included 31 species of *Fomes*, the cultural characteristics of which on malt agar

under controlled environmental conditions are described. The results indicated that these characteristics are sufficiently distinctive to make the identification of the different species fairly certain, and that individual isolates of a given species retain their peculiarities for indefinite periods of time. Listed in the descending order of diagnostic value the macroscopical features are stated to be colour of mat, rate of growth in terms of diameter of colony at some definite time interval, texture of mat and production of coloured zones, and sometimes odour; the microscopic features are presence or absence of clamp-connexions, production of secondary spores, existence of supplementary structures such as cuticular bodies, staghorn branches, hyphal swellings, and the like, and hyphal dimensions. The species of *Fomes* also differed in their temperature relations, and most species showed a decided response to light. Tannic and gallic acids, when added in 0·5 per cent. concentration to malt agar, gave a fairly positive means of distinguishing between the white and the brown rot fungi. A key based on cultural characters is given for the species of *Fomes* studied.

Tchastoukhin (V. J.). Исследования по физиологии грибов. I. Домовые грибы. **Coniophora cerebella** и **Merulius lacrymans.** [Investigations on the physiology of fungi. I. The house fungi *Coniophora cerebella* and *Merulius lacrymans.*]—*Acta Inst. bot. Acad. Sci. U.R.S.S., 1938*, Ser. IV (*Bot. exp.*), 3, pp. 453–534, 18 figs., 1938. [French summary.]

The author describes at some length an apparatus specially constructed by him for culturing fungi in synthetic solutions under strictly aseptic conditions and in controlled atmospheres. He gives an account of the results of his studies on the growth and metabolism of *Merulius lacrymans* and *Coniophora cerebella* [*C. puteana*: *R.A.M.*, xvii, p. 282] in nutrient solutions. It was found that in media with 1 per cent. peptone and 2 per cent. glucose *M. lacrymans* developed much more slowly than *C. puteana.* The latter was shown to form large quantities of organic acids which are exuded into the medium, the final P_H value of which in some cases was as low as 2, although observations indicated that practically no growth of the fungus occurred at P_H 2·7; the optimum P_H was between 5 and 6 in solutions with 0·1 to 0·5 N glucose concentrations. For *M. lacrymans* the optimum in 0·1 N glucose solution was P_H 5, but it was found that the fungus grew consistently better at P_H 3·2 than at 3·9, a point which is being further investigated as it has not been previously recorded for this organism. It also acidified the substratum to final P_H values below 2, and resumed its growth after the medium was replaced by a fresh solution in the flasks. Both fungi freely utilized glucose, levulose, lactose, and maltose, but not saccharose, only 50 per cent. of which was used by *C. puteana* and 28 per cent. by *M. lacrymans* in one month. The polysaccharides dextrin, starch, and cellulose were easily assimilated. No enzymes were found in the medium of cultures of *M. lacrymans*, but maltase and diastase was found in that of *C. puteana*, the mycelium of which was also shown to contain saccharase. *M. lacrymans* was able to utilize inorganic nitrogen compounds, but not *C. puteana*, which only grew in the presence of organic compounds, though its adult

mycelium could use inorganic nitrogen in the form of ammonium salts of organic acids. Neither fungus could use peptone alone as a source of carbon or nitrogen. In a separate series of tests it was shown that in 1 per cent. peptone and 2 per cent. glucose solution the growth of *C. puteana* was inhibited by 0·19 per cent. zinc chloride or 0·06 per cent. sodium fluoride, and that of *M. lacrymans* by 0·01 and 0·05 per cent. of these substances, respectively, the young mycelium being considerably more susceptible to the action of the fungicides than the older. When the nutrient medium under the mycelial mats in flask cultures was replaced by a fresh one containing high doses of the fungicides, the first effect was a marked stimulation of the fundamental physiological processes of the organisms, rapidly followed by complete depression.

Hörning (F.). **Fensterimprägnierung—ein Gebot der Zeit.** [Window impregnation—a modern necessity.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 1, p. 4, 1 fig., 1938.

Excellent results are stated to have been obtained in the writer's nursery-garden in Westphalia by the impregnation of pine wood window frames for 24 hours in a wooden trough, 5 m. long, 25 cm. high, and 25 cm. broad, half full of a 5 to 10 per cent. solution of copper sulphate. Since about 1,250 frames can be treated with 50 kg. copper sulphate at a total cost of Rm. 25 the outlay involved is negligible in comparison with the great increase of durability thus secured. Woodwork immersed 15 years ago in copper sulphate has remained in excellent condition and shows no sign of damage from constant exposure. The method is also applicable to boards and stakes.

Bennett (R. G.). **Some principles of wood preservation observed in the treatment of telegraph poles.**—*J. Soc. chem. Ind., Lond.*, lvii, 2, pp. 27–31, 4 figs., 1938.

This is an interesting discussion of the principles that have been observed by the British Post Office during the past century in the preservation of telegraph poles.

Scots pine [*Pinus sylvestris*] poles are now used exclusively, and the official specification requires that the sapwood should extend to about one-third of the radial depth of the pole; if it is too shallow the protective belt of preserved wood is ineffectual, if too deep the cost of treatment is unduly high.

Trees should not be felled when the sap is 'up', and in no case outside the limits of the normal winter season in the Northern Hemisphere, i.e., before 1st November or after 1st March [see next abstract]. The presence of abundant sap renders the green wood very liable to fungal attacks, and, when dried, the deposits of albuminous and resinous matter in the outer layers and on the wood surface impede the injection of preservatives. 'Floated' poles season more effectively and retain preservative materials better than those not so treated. The poles are carefully stacked to ensure good seasoning, and only when the moisture content of the green wood has been reduced by thorough aeration to 25 per cent. of the weight of the dry wood should preservative treatment be applied.

In 1931 the Post Office discontinued Bethel's full-cell method of impregnation in favour of Rueping's empty-cell process [ibid., xvii, p. 2]. Creosote is used at a rate of not less than 12 lb. (just over 1 gal.) per cu. ft. of wood. The oil pressure may amount to as much as 185 lb. over a one-hour period. On the release of the pressure the air expands and 'kicks back' nearly two-thirds of the injected creosote. A negative pressure of as near 28 in. as the pumps will reach is applied to assist the evacuation of the free creosote. The entire process takes three to four hours. None of the preservatives hitherto tested has proved so uniformly reliable as creosote, some 8,000 poles treated with which between 1866 and 1886 are still standing.

GÄUMANN (E.). **Der Einfluss der Fällzeit auf die Dauerhaftigkeit des Holzes.** [The influence of the felling time on the durability of wood.]—*Schweiz. landw. Mh.*, xvi, 1, pp. 1–11, 1 fig., 11 graphs, 1938.

This is an abridged account of the writer's investigations in Switzerland on the time of felling in relation to the fungal decay of spruce, fir, and beech wood, fuller versions of which have already been noticed from other sources [*R.A.M.*, xvi, p. 354].

VINCENT, HERVIAUX, & COÏC. **Influence de la cyanamide sur la hernie du Chou.** [The influence of cyanamide on club root of Cabbage.]—*C. R. Acad. Agric. Fr.*, xxiv, 3, pp. 83–86, 1938.

In an experiment at the Finistère [Brittany] Agricultural Experiment Station on the control of club root of Milan cabbage (*Plasmodiophora brassicae*) [*R.A.M.*, xv, p. 70], the best results were obtained by the addition to the stable manure of 90 kg. nitrogen in the form of cyanamide per plot of 60 plants, applied with the harrow 20 days before sowing. The percentage of infection in the two plots thus treated was only 22 compared with 47 for those receiving manure alone, 58 for those treated with manure plus calcium nitrate, and 30, 48, 45, and 42 for those receiving cyanamide at sowing, sowing and covering over, and 10 and 20 days after sowing, respectively.

LARSON (R. H.) & WALKER (J. C.). **Properties and host range of a Cabbage mosaic virus.**—Abs. in *Phytopathology*, xxviii, 1, p. 13, 1938.

Natural overwintering hosts of the cabbage mosaic virus [*R.A.M.*, xvi, p. 518] of south-eastern Wisconsin include *Capsella bursa-pastoris* and *Thlaspi arvense*, the vectors of the disease being *Myzus persicae* and *Brevicoryne brassicae*. The virus is inactivated by ten minutes' exposure to a temperature of 55° C., but remains infectious *in vitro* for two days at 20° to 22° and in dilutions up to 1 in 1,000. Systemic infection was obtained on all the cultivated and wild species of *Brassica* tested, *Hesperis matronalis*, *Cheiranthus allionii*, *Matthiola incana*, which developed floral breaking and petal variegation [ibid., xv, p. 98], spinach, Swiss chard [*Beta vulgaris* var. *cicla*], sugar beet, *Zinnia*, *Calendula*, *Nicotiana bigelowii*, *N. glutinosa*, *N. langsdorffii*, *N. multivalvis*, *N. quadrivalvis*, and *N. rustica*. Local lesions were produced on Connecticut Havana No. 38 tobacco, *N. calyciflora*, *N. sylvestris*, the F_1 hybrid

of *N. tabacum*×*N. glutinosa*, and *N. repanda* (followed by systemic infection in the last-named).

TOWNSEND (G. R.). **Reactions of varieties of Snap Beans to rust.**—*Plant Dis. Reptr*, xxii, 1, pp. 2–4, 1938. [Mimeographed.]

Rust (*Uromyces phaseoli typica*) [*U. appendiculatus*: *R.A.M.*, xvii, p. 287] became epidemic on snap beans [*Phaseolus vulgaris*] in southern Florida during the winter and spring of 1935–6 and 1936–7, several thousand acres of the Bountiful and Black Valentine varieties failing completely, though on other occasions and in other localities these varieties have been reported as tolerant or resistant. As a result of trials of ten varieties of snap beans carried out in Florida, Georgia, Maine, Virginia, and other parts of the United States it was found that the reaction of the varieties varied considerably from one locality to another, presumably according to the rust races present or to environmental factors. One variety, 6651, a rust-resistant selection from brown-seeded Kentucky Wonder beans, appeared to be highly resistant or tolerant in every locality where it was tested.

BONDARTZEVA-MONTEVERDE (Mme V. N.) & VASSILIEVSKY (N. I.). Аскохитоз Гороха. [Ascochytosis of the Pea.]—88 pp., 15 figs., 4 diags., U.S.S.R. Acad. Sci. Press, Moscow, 1937. [English summary.]

The results of the authors' studies from 1930 to 1932 at the Botanical Institute of the U.S.S.R. Academy of Sciences, near Leningrad, on the phytopathological analysis of a very large number of pea seed samples, showed that the two major diseases of peas in the Soviet Union are caused by *Ascochyta pisi* and *Didymella* (*Mycosphaerella*) *pinodes* [*R.A.M.*, xvi, p. 435; xvii, p. 287], the first of which is apparently present wherever peas are grown, but is most prevalent and injurious to the crop in districts of European Russia and the Ukraine with comparatively high rainfall; the second occurs chiefly in the northern and central provinces. While the presence of *A. pinodella* [loc. cit.] was not established in Russia, a fungus agreeing closely with Jones's diagnosis but differing in the dimensions of the conidia (which measured 8 to 12 by 3 to 4 μ) was isolated from pea seeds from several localities; the fungus, which is named *A. pseudopinodella* n.sp. [with a Latin diagnosis], was shown experimentally to cause a leaf spot very similar to that due to *A. pisi*, but consistently failed to produce root or crown rot.

A. pisi and *M. pinodes* were shown in cross-inoculation experiments involving 24 different species of Leguminosae to be weakly pathogenic to certain other species of the family besides the pea, for the most part only causing the appearance of isolated spots on a few leaves. Further studies indicated the existence of five forms of *A. pisi* and three forms of *M. pinodes*, differing from one another in cultural characters and also somewhat in their pathogenicity. In pea seeds *A. pisi* was found to retain its viability for at least six years, and *M. pinodes* for about five years.

The other fungi which were most frequently met with in the pea samples examined included three [unnamed] species of *Fusarium*, one

of which was especially common and considerably lowered the germinability of the seed. An unidentified species of *Alternaria* was found fairly frequently inside pea seeds, especially from Siberia, but did not appear to affect their viability appreciably. Bacterial infection of the seed was fairly common, and among the moulds *Penicillium glaucum* was the most prevalent. Three samples were found to be heavily infected with *Moniliopsis aderholdi* [ibid., xvii, p. 183] which, in germination tests, invariably killed the affected seedlings.

ROLAND (G.). **Quelques jaunissements des feuilles de Betteraves.** [Some yellowings of Beetroot leaves.]—Reprinted from *Ann. Gembl., 1938*, 18 pp., 8 figs., 1938.

Brief semi-popular notes are given on a number of diseases and conditions producing a yellow discoloration of beet leaves, including mosaic; 'jaunisse' or yellow spot [virus yellows: *R.A.M.*, xv, p. 548]; yellowing due to *Pythium* sp. [ibid., xiv, p. 209]; 'yellows' caused in Colorado by *Fusarium conglutinans* var. *betae* [ibid., x, p. 428], but not found by the author in Belgium; a condition associated sometimes with a *Verticillium* and at other times with a *Fusarium*, in which a lemon-yellow discoloration generally affects half the blade of the oldest leaves, and the petiole may be discoloured and become necrosed; and the forms of yellowing caused by magnesium [ibid., xvi, p. 649], manganese, and copper deficiencies. A bibliography of 31 titles is appended.

KIRCHHOFF (H.). **Zur Blattfleckenkrankheit der Zuckerrüben.** [On the leaf spot disease of Sugar Beets.]—*Dtsch. landw. Pr.*, lxv, 1, p. 8, 1938.

In 1937 the recognition of beet leaf spot (*Cercospora beticola*) in the Kleinwanzleben district of Germany [*R.A.M.*, xvii, p. 284] was complicated by the simultaneous presence of *Alternaria tenuis* [ibid., xvii, p. 220]. The differences in the intensity of attack repeatedly observed during the past season are attributed, not to diverse varietal reactions to the fungus, which indiscriminately infects all the cultivated strains and even wild beets, but to variations in nitrogen supply. Late applications of nitrogen (end of June to early July) were found to effect a substantial reduction of infection, thereby confirming the results of previous trials in Upper Austria.

BUCHHOLTZ (W. F.) & MEREDITH (C. H.). **A Sugar-Beet root rot caused by Aphanomyces cochlioides.**—Abs. in *Phytopathology*, xxviii, 1, p. 4, 1938.

In August and September, 1937, *Aphanomyces cochlioides* [*R.A.M.*, x, p. 742] was isolated from the decayed tap-roots of a random sample of sugar beets from Kanawha [Iowa] showing 61 per cent. infection. The lesions produced by the fungus were brownish, water-soaked, and slightly soft; many of the roots had become so desiccated and shrunken that only a fibrous, tassel-like structure remained. Such plants showed symptoms of severe wilting eventually ending in death, though this was sometimes delayed by the abundant formation of short slender side roots. Two plug-inoculation experiments in the field resulted in 100 and 91 per cent. infection, while a similar test on harvested beets caused

91 per cent. rot. The symptoms induced by *A. cochlioides* differed from those following inoculation with *Phytophthora drechsleri* [ibid., xv, p. 550], and the former was reisolated in each of the above-mentioned trials. In typical cultures zoospores emerged as delimited protoplasts from unbranched hyphae and became motile in twelve hours. Oogonia, 24 to 29 μ, with branched, enveloping antheridia, were present in two-day-old cultures.

HASSEBRAUK (K.). **Botrytis cinerea Pers. als Spargelschädling.** [*Botrytis cinerea* Pers. as a pathogen of Asparagus.]—*NachrBl. dtsch. PflSchDienst*, xviii, 1, pp. 2–4, 2 figs., 1938.

In 1937 the chlorosis, wilting, and die-back of asparagus caused by *Botrytis cinerea* assumed an exceptionally virulent form in Germany, the development and spread of the fungus no doubt being favoured by the abnormally heavy precipitation from May to August inclusive. The diseased plants almost invariably bore pycnidia, aecidia, and uredosori of *Puccinia asparagi* [*R.A.M.*, xvi, p. 238], the normally profuse growth of which, however, was apparently suppressed by *B. cinerea*. The latter fungus also occurred on rust-free plants grown in specially constructed isolation 'cages', infection in such cases presumably taking place through insect injuries. Preliminary experiments in the elimination of *B. cinerea* by three applications of 2 per cent. Wacker's Kupferkalk on 15th July, 10th August, and 1st September, at the rate of 400 l. per hect. for the first treatment and 500 for the two following, gave promising results, the incidence of infection on three sprayed plots being 2·2, 11·8, and 22·3 per cent. compared with 31·7, 54·6, and 55 per cent., respectively, on the untreated controls.

JOHNSON (H. W.) & LEFEBVRE (C. L.). **Crotalaria mosaic.**—Abs. in *Phytopathology*, xxviii, 1, pp. 10–11, 1938.

A disease characterized by general stunting of the plants, foliar mottling, blistering, and malformation, and abnormally profuse lateral branching (witches' broom) was prevalent in the *Crotalaria* nursery at the Arlington (Virginia) Experiment Farm in 1937, the percentages of infection among the various species being as follows: *C. striata* 86·7, *C. usaramoensis* 76·2, *C. intermedia* 71·6, *C. maxillaris* 58·1, *C. incana* 57·3, *C. spectabilis*, early and late strains, 46·2 and 33·3, respectively, and *C. lanceolata* 31·8, *C. retusa* being unaffected. From 50 to 67 per cent. positive transmission of the virus from *C. spectabilis* and *C. usaramoensis* to *Vicia faba* plants was secured by rubbing the leaves with cheesecloth soaked in mosaic extract, using white quartz sand as an abrasive. The incubation period of the virus was 14 days. Witches' broom or curly disease of *C. anagyroides* and *C. juncea* was reported from Java in 1927 [*R.A.M.*, vii, p. 380], but the present record of the disorder is believed to be the first for the United States.

LAYTON (D. V.). **The parasitism of Colletotrichum lagenarium (Pass.) Ell. and Halst.**—*Res. Bull. Ia agric. Exp. Sta.* 223, pp. 37–67, 12 figs., 1937.

The author measured the relative resistance of cucurbits to anthracnose, caused by *Colletotrichum lagenarium* [*R.A.M.*, xvi, p. 439; xvii,

p. 157], by growing plants from several thousands of seeds together with a standard susceptible check variety (commercial Kleckley Sweet) in duplicate pots, previously steam-sterilized. After inoculation of the plants with spore suspensions of the fungus, they were placed in a moist chamber for 14 to 16 hours at temperatures of 15° to 17° C. and 20° to 30°. They were then kept under observation in ordinary greenhouse conditions, and it was found that no infection resulted from exposure to 15° to 17°, but severe infection from exposure to the higher temperature. A description is given of the typical symptoms of anthracnose, and six species (*Cucurbita texana*, *C. foetidissima*, *Ibervillia tenuisecta*, *Apodanthera undulata*, *Sicyos parviflorus*, and *Luffa* sp.) are added to the host range. Previously unrecorded early symptoms on watermelon in the field consist of small, raised, water-soaked areas located along the vines near the crown of the plant. Of all genera studied *Cucurbita* was found generally to be the most resistant and *Cucumis* and *Citrullus* the most susceptible to anthracnose. The comparative resistance or susceptibility is given of 836 selections and varieties (165 foreign) of watermelon, 139 of cantaloupe, 18 of cucumber, and 21 of *Cucurbita* spp. Detailed information is also given on the breeding of varieties resistant to anthracnose and wilt [*Fusarium bulbigenum* var. *niveum*], a preliminary announcement of which has already been noticed from another source [ibid., xvi, p. 439].

Flachs (K.). **Schädlinge und Krankheiten des Champignons.** [Mushroom pests and diseases.]—*Prakt. Bl. Pflanzenb.*, xv, 8–9, pp. 247–267, 7 figs., 1938.

This is an account of the symptoms and etiology of some well-known insect pests and fungal, bacterial, and non-parasitic diseases of mushrooms [*Psalliota* spp.] in Germany and other countries, with indications for their control.

L. (M.). **L'utilisation du chauffage électrique dans les Champignonnières.** [The employment of electric heating in Mushroom beds.]—*Rev. hort., Paris*, cx, 1, pp. 15–17, 1 fig., 1938.

During the preliminary stages of mushroom [*Psalliota* spp.] culture a soil temperature of 15° to 18° C., approximating to that of the surrounding atmosphere, is high enough for the beds, but during the harvest increased ventilation lowers the temperature of the houses to between 10° and 15°, which should be exceeded in the beds by about 10°. The problem of temperature adjustment may be solved by the installation in the bed of a lead-covered electric heating wire, the heat furnished by which effects a reduction of 50 to 75 per cent. in the quantity of manure required at a consumption of 1 kilowatt-hour daily for 5 yds. of bed yielding an average of 35 to 40 kg. mushrooms during a two-month harvest.

Mundkur (B. B.). **Host range and identity of the smut causing root galls in the genus Brassica.**—*Phytopathology*, xxviii, 2, pp. 134–142, 3 figs., 1938.

Latin and English diagnoses are given of *Urocystis brassicae* n.sp.,

the name applied after further extensive studies to the [Indian] mustard (*Brassica campestris* var. *sarson*) smut previously identified as *U. coralloides* [*R.A.M.*, vii, p. 554]. The spore balls of *U. brassicae* measure 25 to 58 by 20 to 45 μ (mean 38 by 32 μ), with 1 to 5, mostly 2 or 3 fertile cells, the deep brown, fertile spores 13 to 25 by 9 to 20 μ (20 by 16 μ), surrounded by numerous bright brown, elongated, sterile spores, 5 to 15 by 3 to 10 μ (9·9 by 6·1 μ), forming a continuous layer. All these organs are larger in *U. brassicae* than in *U. coralloides*. The spores of *U. brassicae* are formed in wart-like, tuberculate, leaden-grey galls, ranging in size from that of a pea to 1½ in. in diameter, in the underground parts of Indian mustard and (in inoculation experiments with naturally and artificially infected soil) in those of turnip, rape, radish, cabbage, black mustard (*B. nigra*), and *B. juncea*. *U. brassicae* proved to be incapable of infecting *Turritis glabra* and *Matthiola sinuata*, to which *U. coralloides* is pathogenic. Indian mustard plants grown in infested soil flower some five days earlier than those in smut-free soil, and seed formation is adversely affected by the fungus.

GIESECKE (F.) & SCHUPHAN (W.). **Über die Ursachen der 'Rost- oder Eisenfleckigkeit' des Knollenselleries und ihre Behebung bei der Konservierung.** [On the causes of the 'rust- or iron-spot' of Celeriac and its prevention in storage.]—*Z. Untersuch. Lebensmitt.*, lxxv, 2–3, pp. 157–167, 1938.

Further studies on the 'rust- or iron-spot' responsible for serious depreciation in the market value of German celeriac [*R.A.M.*, xvi, p. 652] indicate that the enzyme involved in the discoloration is a peroxidase. In an experiment to determine the influence of heat on the development of the defect, very severe symptoms were observed after two hours on the sliced rootstocks exposed to temperatures of 25°, 46°, and 68° C., but not on those kept at 4° or 87°. The discoloration further increased parallel with the rising alkalinity of the blanching liquid. The prevention of the blemish in stored celeriac may be effected by slicing the rootstocks in ice-cold water and subsequently transferring them straight into boiling water for blanching.

PADWICK (G. W.). **Complex fungal rotting of Pea seeds.**—*Ann. appl. Biol.*, xxv, 1, pp. 100–114, 2 pls., 1938.

After surveying the literature dealing with parasitic diseases of peas the author gives an account of his studies of the fungal flora isolated from pea plants from experimental plots with poor stands in five widely separated pea-growing districts of England. Isolations from the pea seeds sown in the plots, which had been treated with various disinfectants, showed that they were to a very great extent free from parasitic fungi, and indicated that the depleted stands in the plots were not caused by seed-borne *Ascochyta pisi* or *Mycosphaerella pinodes*. Tests of four commercial varieties of peas, known to suffer from poor germination, showed that the cotyledons contained an abundance of common moulds, and several pathogens, including a *Fusarium* of the *roseum* section, *F. culmorum*, and *Botrytis cinerea*. Isolations from surface-sterilized rotting stems from the experimental plots at harvest time

indicated the presence on them of a great variety of fungi, many of which proved to be non-pathogenic to the cotyledons. Among the pathogens *F. avenaceum* was shown to have a high degree of virulence and *F. solani* var. *martii* showed some signs of causing rotting. *B. cinerea* was highly aggressive. Inoculation tests with numerous stock cultures showed the high susceptibility of the pea cotyledons to *B. cinerea* from lettuce, rose, and other hosts, *F. avenaceum* from wheat, *F. culmorum* from wheat, *Dianthus*, and *Callistephus*, species of *Fusarium* from broad beans (*Vicia faba*) and tulips, *Helminthosporium sativum* from wheat, *Ophiobolus heterostrophus* [*R.A.M.*, xiii, p. 366] from rice, *Sclerotinia* sp. from lettuce, and *F. graminearum* [*Gibberella saubinetii*] from wheat.

The results of the work are considered to indicate that the rotting of the cotyledons of pea seeds in the soil is a complex disease, caused by various fungi such as those enumerated above, and that loss of stand due to this rotting is probably more important than the diseases caused by *A. pisi* and *M. pinodes* and foot rots in the later stages of growth.

Löhnis (M[arie] P.). **Brown heart in Swedes (Brassica napus rapifera).**—*Chron. bot.*, iv, 1, p. 9, 1938.

Swede seedlings were grown at the Wageningen (Holland) College of Agriculture in van der Crone's nutrient solution with the addition of traces of manganese, copper, aluminium, and iodine, and of boric acid at the rates of 0·125, 0·25, and 0·5 mg. per l. The roots were examined after $3\frac{1}{2}$ months and all except those supplied with boric acid at the highest rate revealed abnormalities of the cambial cells identical with those observed in field plants suffering from brown heart [*R.A.M.*, xvii, p. 284].

Marsais (P.). **Le court-noué parasitaire de la Vigne.** [Parasitic court-noué of the Vine.]—*Rev. Path. vég.*, xxv, 1, pp. 33–45, 3 figs., 1938.

This is an expanded version of the author's recent paper on the latest developments in the study of the parasitic court-noué of the vine (*Pumillus medullae*) [*R.A.M.*, xvii, p. 291].

Liro (J. I.). **Die wichtigsten Daten der Pflanzenschutzgesetzgebung Finnlands.** [The most important data of plant protection legislation in Finland.]—*Veröff. LandwMinist.*, 19, 17 pp., Helsingfors, 1937. [Abs. in *Rev. appl. Ent.*, Ser. A, xxvi, 4, p. 201, 1938.]

This is a summary of the legislation regulating the importation into Finland of plants and plant products.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xii, 2, p. 32, 1938.

Chile. Under the terms of Decree No. 536 of 20th August, 1937, avocado pears imported into Chile from Peru must be free from infection by anthracnose (*Physalospora* [*Melanops*] *perseae*) [*R.A.M.*, xiv, p. 124], and must further originate in regions where the cankers produced by the fungus have been almost entirely eradicated and a continuous system of elimination is operative.

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WASEWITZ (H.). **Beiträge zur Biologie und Bekämpfung der durch Sclerotinia minor Jagg. verursachten Salatfäule.** [Contributions to the biology and control of the Lettuce rot caused by *Sclerotinia minor* Jagg.]—*Angew. Bot.*, xx, 1, pp. 70–118, 5 figs., 1938.

During 1936–7 the writer instituted an extensive series of investigations on the possibilities of controlling lettuce rot (*Sclerotinia minor*) in the Wiesbaden district of Germany [*R.A.M.*, xvi, p. 369], where the annual losses from this source amount to Rm. 50,000 to 70,000, corresponding to a yield reduction of 30 to 80 per cent., similar damage being also reported from Bavaria and Saxony.

In addition to lettuce, *S. minor* has been found attacking endives, radishes, carrots, asparagus, and beans [*Phaseolus vulgaris*], while in one case it was also detected on cauliflower. Both sound and wounded tissues may be invaded, either through the collar or by way of the basal leaves in close proximity to the soil. The fungus was further shown to be capable of developing and forming sclerotia on dead plant organs. Severe outbreaks of the rot are favoured by fluctuating spring temperatures, excessive atmospheric humidity, light soils (either acid or alkaline), greenhouse cultivation, and failure to observe a judicious order in crop rotation. Cultural control measures should be based on the avoidance of such adverse factors, supplemented by soil treatment either by chemicals or steam sterilization [full details of which are given] on the lines previously indicated. In a varietal reaction trial at the Giessen plant protection head-quarters the lettuce varieties Stuttgarter Dauerkopf, Maikönig (strains 2 and 3), Zichoriensalat, Wunder von Holland, Wunder von Stuttgart, Alter Frankfurter, and Ideal were slightly affected, Bohemie, Maikönig (strain 1), Trotzkopf, and Forellensalat moderately so, and seven other varieties were strongly susceptible.

Итоги научно-исследовательских работ Всесоюзного Института Защиты Растений за 1936 г. Часть I. Вредители и болезни зерновых культур и полезащитных полос. [Summary of the scientific research work of the Institute of Plant Protection for the year 1936. Part I. Pests and diseases of cereals and shelter belts.]—252 pp., 6 figs., 9 diags., 27 graphs, 4 maps, Издат. Всесоюз. Акад. с.-хоз. Наук им. В. И. Ленина. [Publ. Off. Pan-Sov. V. I. Lenin Acad. agric. Sci.], Leningrad, 1937.

This collection of papers by various authors on diseases of cereal

crops and shelter belts of trees contains the following items of interest.

P. A. Proyda (pp. 72–76) in his report on the dry heat treatment of seeds of spring wheats for the control of loose smut [*Ustilago tritici*] points out that the mycelium of this fungus can be killed by temperatures of 52° to 53° C. before it becomes dormant some 10 days after the seed has fully matured, but withstands much higher temperatures later. Exposure for 7 minutes in air heated to a temperature of 52° reduced the infection from 3·7 and 4 per cent. in the control seed of different degrees of ripeness to 0·4 and 1·1 per cent. in treated seed and to 0·3 and 0·5 per cent. in seed previously heated for 4 hours at 28° to 32°. The same pre-heating and the same temperature and period of exposure applied in hot-water treatment reduced the infection to nil. The dry heat treatment decreased the percentage germination of the seed in proportion to the original germination ratio of the treated seed; treatment for one hour at 80° reduced the percentage germination of the spring wheat Novinka from 82 to 46 per cent. in the seed harvested after the wet season 1935 and from 98 to 80 or 90 per cent. in seeds harvested after the dry season 1936.

Several authors studied the effect of hydrogen sulphide on cereal seeds for the control of various smuts and bunt [*Tilletia caries* and *T. foetens*: ibid., xvi, p. 26]. V. I. Lobik (pp. 76–78 and pp. 111–113) states that exposure for 72 hours in a concentration of hydrogen sulphide of 600 gm. per cu. m. killed the spores of *U. hordei*, *U. avenae*, and *U. panici-miliacei*. The treatment was found to injure the germination of the seed unless the seed was aired and dried for from 5 to 12 days after fumigation; a water content of over 17 per cent. allowed to persist in the treated grain inhibited germination altogether. Similar results were obtained by E. F. Topekka (pp. 96–99) and Mme A. P. Petrova (pp. 94–96).

Mme A. T. Tropova (pp. 81–84) studied the effect of air humidity and temperature on the infection of wheat with *U. tritici*. Artificial infection of seeds in 1935 at a temperature of 25° to 26° and an air humidity of 60 per cent. resulted, in 1936, in 46 per cent. diseased plants, and the raising of air humidity to 100 per cent. resulted in 84·1 per cent. diseased plants. The increase of temperature from between 13° to 14° to between 25° to 26° at an air humidity of 70° to 75° resulted correspondingly in 39 and 73 per cent. diseased plants.

S. S. Skvortzoff (pp. 87–89) suggests that the higher rate of respiration and the greater activity of the catalase in the wheat seed infected with *U. tritici*, which are apparent in the milky and waxy stages of maturity only, may serve as diagnostic factors.

V. K. Grushevsky (pp. 104–111) gives a description with diagrams and figures of the model of an apparatus for dry thermal disinfection of seed against loose smut [*U. tritici*] designed by N. I. Khodakovsky. In this machine the grain is heated to a temperature of 80° for one hour by gaseous products from the combustion of straw and wood, which are filtered and mixed with atmospheric air. It is suggested that the present stationary model should be changed into a portable type and that the present capacity of 1,000 kg. should be reduced to 250 or 500 kg., a size more suited to the needs of the average farm.

Mme S. P. Zybina (pp. 114–116) studied the virulence of different geographical populations of wheat bunt (*T. tritici*) [*T. caries*] [ibid., xvi, p. 27] and *T. levis* [*T. foetens*], inoculation tests being carried out on ten varieties of wheat in the laboratory and in the field. The results showed that *Triticum timopheevi* from western Georgia was immune from all collections of bunt except the strain collected on this host in 1936. *T. monococcum* from western Georgia was immune from all populations in the tests, but under natural conditions it is reported to be not entirely free from infection.

S. M. Tupenevitch (pp. 119–122) states that the harmful activity of *Fusarium nivale* [*Calonectria graminicola*: ibid., xv, p. 790], associated with 'snow mould' of winter-sown grain, begins in the early spring at temperatures from 4·3° to 22° and is favoured by high air humidity. Drainage, fertilization, and top-dressing of the fields in early spring are recommended as measures of control.

P. V. Pak (pp. 124–125) points out that high water content (over 18 per cent.) of cereal seed-grain favours the development of species of *Fusarium* [ibid., xv, p. 789] on the harvested grain during drying and storage; in seeds containing 8 to 14 per cent. moisture infection is diminished. Two to three years of storage is stated to reduce the infection in dry seeds to practically nil; heating the dry seed for 30 minutes at a temperature of 70° reduces the infection by about one-half.

S. V. Vladimirsky (pp. 125–128) reports on the factors favouring the development of foot rot of wheat, due to *Helminthosporium sativum* [loc. cit.] in the Voronezh Region, which in some years may cause reductions in yield of from 5 to 9 per cent. Experiments with seeds artificially infected either by soaking in a spore suspension or by inoculation of the embryo through a wound showed that lack of moisture in the soil (30 per cent.) during the tillering stage considerably lowered the vitality of the plants and resulted in 5·3 per cent. leaf-spotting and 7·1 per cent. stem-browning, the corresponding figures for plants grown continuously at 60 per cent. soil moisture being 4·0 and 3·5. Shelter belts are considered to exert a good influence since the amount of infection of spring and winter wheats growing in soils situated near them and containing 22·5 to 36·2 per cent. moisture was 1·3 and 2·1 per cent., respectively, whereas in steppe soils [without shelter belts] containing 21·7 to 34·0 per cent. moisture infection amounted to 2·2 and 3·3 per cent., respectively. The spring wheat varieties Palestine, Tunis, Morocco, and the winter wheat type *ferrugineum* showed a fair degree of resistance to the disease in field tests.

M. V. Gorlenko (pp. 128–129) gives further data on the bacteriosis of wheat [*Bacterium translucens* var. *undulosum*: ibid., xvi, p. 243] in the Voronezh Region. The disease reduced the yield of the types *milturum* 0544, *lutescens* 1060/10, *ferrugineum* 085, *ferrugineum* 02, *caesium* 0111, and *milturum* 0321 by 31·1, 45·1, 38·1, 27·6, 55·4, and 42·8 per cent., respectively. The heights of diseased and healthy plants of *milturum* A–24131 were 66·7 and 68·4 cm., respectively, the corresponding figures for *caesium* 0111 being 58·2 and 63·6 cm. The length of ears and the number of spikelets in *caesium* 0111 were 6·2 cm. and 8·8, respectively, in the diseased against 7·7 cm. and 11·18 in the healthy plants, and in *milturum* 0544 9·4 cm. and 15·2 as against 9·6 cm. and

16·4. Evidence that the seed is the main source of infection was afforded by the fact that seed collected from diseased plants yielded almost 100 per cent. infected plants.

V. K. Zazhurilo and M. V. Gorlenko (pp. 129–132) give a detailed description of the symptoms of wheat mosaic [ibid., xiv, p. 493], as observed in the Voronezh Region, which corresponds with the description of the yellow mosaic of wheat by McKinney [ibid., x, p. 646] and others [ibid., xvii, p. 379]. In field tests almost all varieties of winter wheats were susceptible to the disease, showing 5 to 34 per cent. of infection; most of the spring wheats, including the standard variety *caesium* 0111, showed no signs of infection.

V. K. Barteneff (pp. 134–136) describes the symptoms of black leaf spot [of unknown etiology] of sunflower [*Helianthus annuus*: ibid., xii, p. 571], which occurred rather extensively in the Voronezh Region in 1936, causing reductions in yield of 2·12 per cent. The disease spreads upwards in the plant forming transparent patches with black spots in them in the leaves, which eventually dry and fall off. Even a moderate intensity of infection reduces the size of the inflorescence and the number of seeds in each plant. Plant debris is one of the sources of infection. Autumn-sown plants showed in all field tests less infection than spring sown.

On pp. 137–145 several authors give a general survey of the work on cereal rusts [*Puccinia triticina* and *P. graminis*] for the year 1936 and furnish data on the distribution of rusts in the U.S.S.R. in general, and in East Siberia [ibid., xv, p. 348] and the Azoff–Black Sea Region in particular [ibid., xv, p. 785].

Mme V. Bryzgalova (pp. 146–148) announces the discovery of a new aecidial host of the brown wheat rust (*P. triticina*) in East Siberia. Artificial inoculation of the overwintered rosettes of *Isopyrum fumarioides* of the Ranunculaceae with teleutospores from *P. triticina* gave positive results in every case; artificial inoculation of wheat with aecidiospores from *Isopyrum* resulted in 73 per cent. infection in one test and 95 per cent. in a parallel test. The climatic conditions of the region are such as to permit the germination of the teleutospores in autumn in some years.

According to Mme N. I. Petrusheva (pp. 148–150), the following physiological races of *P. triticina* were observed in 1936 in the Leningrad region: the most prevalent was race 20, followed in order by races 65, 13, and 70.

A. S. Barmenkoff (pp. 150–152) [ibid., xvi, p. 163] sums up the results of research work in the U.S.S.R. on the physiological races of *P. triticina* from 1931 to 1936. Of the 25 different races so far observed, 20 and 65 are the most prevalent and have been observed before 1936 together with 9, 10, 13, 17, 19, 21, 24, 31, 53, 64, 66, 67, 68, and 69. Races 70 to 78, inclusive, are reported for the first time for the country.

Mme V. F. Rashevskaja (pp. 152–154) [loc. cit.] states that wheat varieties belonging to *T. vulgare*, *T. compactum*, *T. spelta*, *T. sphaerococcum*, *T. dicoccum*, *T. persicum*, *T. macha*, and *T. dicoccoides* were all strongly susceptible to races 17, 20, and 65 of *P. triticina*; *T. monococcum* was resistant to the same races, and the barley variety Wiener was immune from all races of *P. triticina* and from the rye rust (*P. dispersa*).

Mme E. P. Goryatcheva (pp. 155–159) discusses the ecological characteristics of physiological races of *P. triticina* of different geographical origin. The optimum temperature for uredospore germination was almost the same (15° to 22°) for all the races tested (13, 17, 20, 65, and 68). Race 20 from different regions reacted differently at temperatures near the minimum (5° to 6°) and maximum (29° to 30°) for germination, whereas race 65 from different regions showed consistently the same reaction.

Mme V. Bryzgalova (pp. 166–167) [ibid., xv, p. 348] states that the minimum, optimum, and maximum temperatures for the spore germination of *P. triticina* in East Siberia are, respectively, 2° C., 5° to 8°, and over 20° for aecidiospores, 2°, 15° to 22°, and 26° for uredospores, and 2°, 9° to 14°, and 20° for teleutospores.

A. G. Marland (pp. 168–170) studied the influence of temperature on the development of *P. coronifera* [*P. lolii*: ibid., xv, p. 783] on oats. Aecidiospores and uredospores placed in drops of water on the leaf during the seedling stage germinated and the germ-tubes penetrated into the tissue within 5 hours at temperatures between 11° and 30° C., and after only 3 hours at 20° to 22·8°; complete infection leading to the later development of pustules took place after 5 to 6 hours at temperatures between 14° and 27°, but only after 10 hours and more at lower or higher temperatures. The incubation period of the disease resulting from inoculation with aecidiospores and uredospores varied little in the seedling and flowering stages under natural conditions; for seedlings it lasted 7 days at an average temperature of 19·3° and 14 days at 10·7°.

Mme L. L. Pronitsheva (pp. 175–178) gives some data on the control of wheat rusts (*P. triticina* and *P. graminis*) in the Azoff–Black Sea Region. It is stated that the aecidial stage of *P. triticina* has not been found on its aecidial host, *Thalictrum*, growing in this region and that the fungus perpetuates itself entirely on wheat. Autumn development takes place in August–September on volunteer plants, which become infected from the stubble and plant debris and are the main source of infection for the young winter wheat. Bad results are obtained when winter wheat is sown after winter or spring wheat, but not when spring wheat is sown after winter wheat, as the spring ploughing destroys the volunteer plants and the rust spores cannot overwinter on plant debris. Sowing between 15th and 20th September ensures the same yield as the earlier dates and lessens the incidence of both rusts. Vernalization decreases the incidence of both rusts in spring wheats only when combined with early dates of sowing. The resistance of wheat varieties to the physiological races of *P. triticina* found in the region (races 13, 17, 20, 65) was found to vary with the age of the plant. Only very few varieties (Fulhard, Kawvale, Kanred × Fulcaster 266287, Kanred × Fulcaster 266319, and Melanopus 069 from the Krasnodar Experiment Station) were resistant to the rust in the seedling stage.

Mme A. A. Shitikova-Roussakova (pp. 178–180) and I. M. Polyakoff (pp. 180–182) describe the results of tests with new fungicides for the control of wheat rusts. According to I. M. Polyakoff, the scorching property of Preparation No. 12 from the Institute of Plant Protection was successfully eliminated by the addition of oil. The improved

preparation now consists of 5 per cent. sodium silico-fluoride, 93 per cent. fine clay, and 3 per cent. thin lubricating oil. In dusting tests started on 22nd June, applications were made every 5 days at a rate of 30 kg. per hect. on stands of 30 sq. m., each divided into 10 plots. Dusting of the variety Durable with Preparation No. 12 applied at the beginning of the milk stage of maturity gave averages of 0·72 green leaves per plant and 27 pustules per leaf as compared with 0·70 and 84 in the controls and 0·75 and 50·3 in plants dusted with sulphur; the application of the same dust under the same conditions to variety *lutescens* 062 gave 0·71 green leaves and 9·3 pustules per leaf as compared with 0·75 and 22·4 in the controls and 0·76 and 16·6 in plants dusted with sulphur.

Mme R. I. Kikoina (pp. 182–185) sums up the effect of cultural measures on the development of wheat rusts in the Azoff–Black Sea Region [ibid., xv, p. 708]. Field plot tests showed that early dates of sowing (10th to 25th September) led to heavier incidence of *P. triticina* but gave better yields than later dates; in the case of *P. graminis* early dates of sowing resulted in a lesser degree of infection as well as better yields. Spring harrowing of winter wheats is also stated to exert a beneficial effect on the incidence of *P. triticina*.

D. V. Sokoloff (pp. 238–242) gives a few data on the control of diseases of trees in shelter belts. Collecting fruit bodies of *Polyporus squamosus* [ibid., xvi, p. 358], causing white stem and root rot of American maple [*Acer*] and elm, proved an effective and economical measure, one boy being able to cover in 4 hours 16 to 20 hect. in wide stretches with little undergrowth and 5 to 8 hect. in narrow stretches and young stands. In dusting experiments for the control of powdery mildew of oak, caused by *Microsphaera alphitoides* [*M. quercina*: ibid., xv, p. 63] the best results were obtained with sulphur-dusting at the rate of 40 to 60 kg. per hect. of a two-year-old oak stand, resulting in no diseased leaves against 22·7 per cent. in the control. It was observed that *Gloeosporium umbrinellum* [ibid., xv, p. 259] and *Septoria quercina* [ibid., vii, p. 428], causing brown leaf spots of oak, mostly attack leaves injured by *Phylloxera quercina*. Spraying with a 2 per cent. oil emulsion of copper naphthenate against the insect indirectly checked the disease, the percentage of diseased leaves being reduced from 19·7 in the untreated controls to 1·4 and 5·7 in two experimental plots.

Итоги научно-исследовательских работ Всесоюзного Института Защиты Растений за 1936 г. Часть II. Вредители и болезни технических и плодовых культур. [Summary of the scientific research work of the Institute of Plant Protection for the year 1936. Part II. Pests and diseases of industrial and fruit crops.]—pp. 255–444, 22 figs., 13 diags., 18 graphs, Издат. Всесоюз. Акад. с.-хоз. Наук им. В. И. Ленина. [Publ. Off. Pan-Sov. V. I. Lenin Acad. agric. Sci.], Leningrad, 1937.

This collection of papers by various authors on diseases of industrial and fruit crops contains the following items of interest.

Mme T. I. Fedotova (pp. 268–270) reports that the results of the serological analysis applied in wilt [*Fusarium buharicum* or *Verticillium dahliae*] resistance tests on 130 varieties of cotton [*R.A.M.*, xvii, p. 109] showed 80 per cent. agreement with the results of field experiments and

indicated the degree of wilt resistance not only in varieties, but even in pure lines within the limits of one variety.

Mme V. I. SHALYSHKINA (pp. 270–273) obtained some preliminary data on the length of the incubation period of the leaf form of cotton blackarm (*Bacterium malvacearum*) [ibid., xvi, p. 380] in relation to atmospheric temperature. The length of the period varied with the change of temperature from 4 days in August (average daily temperature 30° C.), to 5 days at the end of July–beginning of August (28°), 6 days in July (20° to 26°), 12 days in September (14°), and 17 days in October (12°).

Mme FOKINA (pp. 273–274) describes her investigations into the pathological anatomy of cotton affected by *Bact. malvacearum* [ibid., xvi, p. 248]. Seeds partly immersed in a suspension of the organism so that the micropyle was covered showed a high percentage of infection at subsequent germination in soil, whereas no infection at all resulted when the chalazal end was submerged. Infection must therefore take place through the micropyle. The bacterial masses were found concentrated on tissues of the endosperm, situated directly under the micropyle, whence the infection passes to the cotyledons. It was observed that plants with high germination energy freed themselves quickly from the seed coat and adhering fragments of endosperm, and thus escaped infection. The apical bud can become infected through direct contact with the diseased cotyledons or with bacteria living on the inner surface of the seed coat, and the infection may cause the death of the whole germ, the destruction of the stem, or, if the degree of infection is slight, it may simply persist in the seedling. The growth of the petiole of the infected cotyledons and the formation of lateral buds are quicker than the spread of infection and therefore axillary buds can remain healthy. On entering the stem the organism becomes localized in the primary wood but eventually enters the secondary wood, leading to partial necrosis.

Mme A. V. STEPOUNNINA (pp. 275–276) gives some information on the toxicity of meranin [ibid., xvi, p. 275] and furfurol to *Bact. malvacearum*. Exposure for 60 minutes to a 0·03 per cent. concentration of meranin (synthesized by L. G. Makorova) destroyed the bacteria but did not adversely affect the germination of the seed, and a similar result was obtained with furfurol.

G. T. VYSKVARKO and V. I. ULYANISHTSHEFF (pp. 276–278) sum up the results of experiments with several new seed disinfectants against cotton blackarm (*Bact. malvacearum*) [ibid., xvi, p. 171]. Exposure for 10 minutes in 2 and 4 per cent. solutions of acid coal tar containing free sulphuric acid, ethers, and aromatic sulphonated acids produced 1·17 and 1·44 per cent. of stem infection, as compared with 2·24 per cent. in plants treated with 1:100 formalin, and with 17·72 per cent. in control plants. The effectiveness of formalin solutions was somewhat raised by the addition of 0·1 per cent. of sulphonated acids.

I. A. MEISSAKHOVITCH (pp. 285–288) reports on some further improvements in Heid's cereal seed-disinfecting apparatus [ibid., xvi, p. 249], leading to the construction of a new machine called Poum I, which can be used for cotton seed as well as for cereal grain.

K. I. Kalashnikoff (pp. 300–302) investigated the effect of temperature on the development of *Cercospora beticola* on beet [ibid., vii, p. 693; xvii, p. 367] under natural conditions. Up to the middle of September conidia of this fungus germinated in one day's time at the rate of 74 to 93 per cent.; later in the season the germination period extended to two days. The optimal temperature for the growth of mycelium appeared to lie between the average of 23·1° and the maximum of 35·9°; at lower temperatures the growth slowed down. Neither sporulation nor development of the disease, however, appeared to be dependent upon the temperature factor.

B. P. Matzulevitch (pp. 318–320) employed the serological method for identifying different forms of beet mosaic [ibid., xiii, p. 210; xvii, p. 428], such as marbled, speckled, and spot necrosis. The immunization of rabbits was achieved with antigens of all these viruses, previously purified with gelaluminium. The results of the experiment showed that all the tested types of mosaic of beet were caused by the same virus. The experiments appeared to confirm the work of Verplancke as to the possibility of transmission of infection through seed and sap.

A. M. Sigrianski and Mme Z. N. Otpushtshennikova (pp. 338–339) report on the combined occurrence of *Pseudopeziza trifolii* [ibid., xiv, p. 241], *Polythrincium* [*Dothidella*] *trifolii* [ibid., xv, p. 26], and *Ascochyta trifolii* [ibid., xi, p. 654] on red clover [*Trifolium pratense*], of which the first attacks the plant at the stage of tillering and incipient bud formation (3rd June), the second at the stage of bud formation proper (about 10 days later) and the third at the onset of flowering. The diseases were at their worst on 3rd July (average temperature 18·1°, average vapour pressure 11 mm.) when the incidence of infection amounted to 49·8 per cent.

The same authors (pp. 341–342) give a list in tabular form of microorganisms found on seeds of red clover of local and Czechoslovakian origin and the percentages of infection caused. The list comprises *Botrytis anthophila* [ibid., xiii, p. 390], *Fusarium* spp.; bacteria, *Alternaria tenuis* [ibid., x, p. 425], *Cladosporium* spp. and *Penicillium* spp. *A. tenuis* does not appear to be responsible for browning of the seed coat and the low germinability of seeds, since it was not observed on the Czechoslovakian seeds, which showed 24 per cent. of browning. All the above-mentioned pathogens are fairly resistant to seed treatment with formalin or mercuric chloride, but exposures for 5 minutes to a 0·5 per cent. concentration of mercurized aniline was detrimental to all of them.

A. M. Sigrianski and Mme O. M. Minyaeva (pp. 339–341) describe the results of their study of *B. anthophila* on red clover. Single hyphae or a clump of mycelium of this fungus can be easily detected in sections of the seed, concentrating mostly in the small cavity near the embryo, or sometimes round or within the embryo. Preliminary germination experiments showed that infection of the seeds does not always lead to the infection of the seedlings. Within the diseased plant the fungus penetrates roots, stem, petioles, and all parts of the flower, but sporulates only on the anthers and sometimes in the gynoecium. The presence of the fungus in the ovary does not inhibit the production of seed, and the output of infected seeds is therefore very high. The secondary infection is carried by all flower-visiting insects, especially by *Apion*,

and possibly by wind from overwintered diseased plants of the cultivated and wild red clovers. The formation of mycelium was observed on the petals on the 5th day after inoculation, in the style on the 10th day, and in the ovary on the 15th day. The mycological analysis of 560 flowers showed 13 diseased and 11 healthy among the light-coloured, 5 diseased and 1 healthy among the 6 bright-coloured, and 42 diseased and 488 healthy among the 530 normally-coloured flowers.

A. M. SIGRIANSKI and Mme T. J. POTAPOVA (pp. 342–344) describe some of the results of series of experiments begun on anthracnose (*Gloeosporium caulivorum*) [*Kabatiella caulivora*: ibid., xvi, p. 754] of red clover. The organism appeared to develop best on agar media containing glucose and ammonium nitrate, and on liquid media. Hot and dry weather in the summer of 1936 arrested the spread of the disease, which developed fully only from September, at an average temperature of 9° to 16·2° and an average relative humidity of 79 to 85 per cent., till the onset of snowy weather. Artificial inoculation of the flower, the upper part of the peduncle, the stem, and the bracts of the first, second, and third internodes with or without puncturing of the epidermis produced the symptoms of the disease in the form of brownish patches, and the formation of conidia took place after 10 to 15 days, 5 to 10 days, 5 to 10 days, and over 10 days, respectively. The lower part of the stem showed no infection.

Mme N. ZELENOVA (pp. 351–355) discusses the results of comparative applications of the serological method and of field tests in determining the resistance of flax varieties to *Melampsora lini* [ibid., xvii, p. 323] and *Fusarium lini* [ibid., xvii, p. 396], which showed an agreement of 83 per cent. in the case of the first fungus and almost complete agreement in that of the second.

Mme A. A. OVTSHINNIKOVA (pp. 376–378) reports on the occurrence of *Monilia* [*Sclerotinia*] *fructigena* and *M.* [*S.*] *laxa* [ibid., xvi, p. 190] on pome fruits in the Krasnodar region. *S. fructigena* attacked mostly fruit and fruit branches, whereas *S. laxa* was found causing blossom blight, branch and shoot necrosis, and fruit rot on apples and pears; the fungus entered the plant when still in the flowering stage, mostly through injuries inflicted by *Rhynchites bacchus*, *Tinetocera*, *Cocoecia*, and *Pandemis*. It was observed during the year that, on pear trees, *S. fructigena* developed almost without exception in wounds or cracks caused by *Fusicladium pirinum* [*Venturia pirina*].

F. E. POUSHIN (pp. 429–434) describes a new motor-sprayer for large fruit orchards. The apparatus [of which two illustrations and one diagram are given] consists of two pairs of vertical pipes fitted with lateral spray nozzles and suspended from a high framework on either side of the machine. The two pairs of pipes fit over the trees on each side as the machine passes between the rows.

POLE EVANS (I. B.). **Survey of a year's research work. Annual Report of the Division of Plant Industry.**—*Fmg S. Afr.*, xii, 141, pp. 528–547, 14 figs., 1937.

Among the numerous items of phytopathological interest in this report [cf. *R.A.M.*, xvi, p. 367] the following may be mentioned. In connexion with an inquiry into the etiology of November drop of

oranges in the Kat River Valley, *Alternaria citri* [ibid., xvii, p. 310] was found to occur almost as frequently in normal green fruits as in dropped ones. Of 40,000 dropped fruits collected in a block of 1,000 trees, 17 per cent. were infected by navel-end rot.

Of 652,820 citrus trees inspected in the eastern Cape Province, 909 were affected by psorosis, while only 26 diseased specimens were detected among a total of over 107,000 examined in the western areas.

'Kromnek' [believed to be identical with spotted wilt: loc. cit.] of tomatoes was reported to be causing heavy damage at Port Elizabeth, where it was previously unknown. A closely similar disease has been observed attacking up to 50 per cent. of the petunia plantings near Pretoria. The virus of tomato bunchy top was found to be transmissible through the seed to seedlings of *Solanum ircanum*, as well as to *Datura stramonium*, the latter showing no visible reaction and acting as a carrier. Both the tomato and tobacco crops suffered extensively from mosaic, especially in the Rustenburg area of the Transvaal; the disease is probably responsible for a serious depreciation of quality (spotting and burning) as well as quantity in the foliage of affected tobacco plants. The sugar-cane varieties Co. 281 and 301, now widely grown in Natal, have proved to be highly resistant to streak.

All the rusted wheat samples so far examined in the summer rainfall area have yielded physiologic race 34 of *Puccinia graminis*, to which only 4 out of 106 South African wheats were found to be resistant, while 8 reputedly resistant varieties from Kenya and 4 from Canada also succumbed to infection. Inoculation experiments with the rust further gave positive results on 75 cross-bred wheats from Potchefstroom.

In inoculation tests on maize with *Gibberella saubinetii* and *Diplodia zeae*, ear infection occurred at any time during growth, invasion taking place either through the silks or directly through the leaves of the sheath. Wounds are necessary for infection by *Fusarium moniliforme* [*G. moniliformis*] and *F. moniliforme* [*G. fujikuroi*] var. *subglutinans*.

Exceptionally severe outbreaks of *Cercospora* [*personata*] and *Sclerotium* [*rolfsii*] caused serious damage to the Springbok Flats and northern Transvaal groundnut crops.

A *Fusarium* wilt of sann hemp [*Crotalaria juncea*: cf. ibid., xvii, p. 40, and below, p. 445] was reported from Brits and the Kat River Valley, where the crop is used for cover purposes in citrus orchards.

An outbreak of potato blight (*Phytophthora infestans*) occurred in the northern Transvaal, a rare event in South Africa.

Details are given of the work in progress at the Low Temperature Research Laboratory, Cape Town, in connexion with storage of various fruits and eggs [see below, p. 469].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 2, pp. 67–72, 7 figs., 1938.

Investigations are stated to have shown that a considerable part of the extensive wastage which in 1936 occurred in Ohanez export grapes in the form of internal breakdown, fruit and stalk rots caused by various [unspecified] fungi, and fruit shedding [*R.A.M.*, xv, p. 482] was chiefly attributable to careless handling of the grapes during

harvest, inadequate packing, and the lack of the necessary precautions before and during cold storage. The solution of the wastage problem lies in the growers, packers, and exporters paying close attention to these points.

A brief description [with diagram] is given of a type of 'spike harrow' [ibid., xiv, p. 460] which is said to be gaining favour for soil sterilization by steam in tomato glasshouses in Sydney.

Notes are given on three virus diseases of dahlia recorded in New South Wales, namely, mosaic [ibid., xiv, p. 634], stunt [ibid., xii, p. 697], and [tomato] spotted wilt [ibid., xv, p. 280; xvi, p. 285].

Laboratory and greenhouse studies of the causes of the defective germination of pea seeds, which during the few past seasons has been experienced by pea-growers in different parts of the State, resulting in thin stands or complete failures, showed that defective seed lots harbour certain fungi which apparently establish themselves in seeds injured during or subsequent to harvesting but are not carried in normal seeds, and which under favourable conditions may inhibit germination or bring about the partial or complete destruction of the seedlings [cf. ibid., xvii, p. 431].

Eleventh Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1937.— 89 pp., 1937. [Received March, 1938.]

In this report [cf. *R.A.M.*, xvi, p. 233] it is stated that a survey made in Australia of the incidence and relative importance of the diseases causing apple 'die-back' and 'sour sap' [ibid., vii, p. 791; ix, p. 434] showed that fungal root rots, e.g., *Armillaria mellea*, wound parasites, e.g., *Polystictus versicolor*, malnutrition, and loss of surface soil by erosion are all causative factors, which, however, vary in importance in different localities, and individually are seldom the most frequent cause in any district. The most important and widely prevalent form of apple die-back is that known as 'pruning die-back' in Western Australia and 'rosette' or 'little leaf' in Queensland and South Australia; this disease, the cause of which has not yet been ascertained, occurs in all areas north of latitude 36° S., becomes severe north of latitude 35° S., and appears to become worse the farther north one goes.

Pre-storage exposure for 36 hours to atmospheres containing 50 per cent. of carbon dioxide induced brown heart [ibid., xvi, p. 233] in Sturmer Pippin and French Crab apples, but not in Cox's Orange Pippin, Scarlet Pearmain, or Jonathan. Increase in the concentration of respired carbon dioxide in the storage chamber appears to increase liability to brown heart, induce Jonathan spot [ibid., xvi, p. 107] in mature fruits, and reduce late scald in Sturmer Pippin apples. Severe brown heart of pears [see below, p. 468] developed after 8 weeks' storage in atmospheres containing over 10 per cent. carbon dioxide.

In breeding for resistance to flag smut [*Urocystis tritici*: ibid., xvii, p. 228] it was found that the selection of individual plants for freedom from infection is useless, at least in the early hybrid generations, but selection based on progeny tests is effective.

The viruses causing destructive diseases in 17 potato varieties in Victoria were nearly all of the Y type. X type viruses occurred in a

latent or semi-latent form in all samples of the common commercial varieties examined from Victoria, New South Wales, Tasmania, and Western Australia. So far three groups of latent potato viruses have been distinguished, viz., the X type (including ring spot, mottle, and yellow mottle), B, and F.

Extensive grafting experiments gave no evidence that needle-fusion of pine trees [ibid., xvii, p. 149] is infectious. Susceptibility greatly declines three to eight years (according to the species) after the trees are planted out.

The British Food Investigation Board and the Citrus Preservation Technical Committee have agreed on the following classification of non-parasitic disorders of stored citrus fruits: (1) storage spot (*a*) button lesions, (*b*) lateral lesions [ibid., xvi, p. 233], (2) scald, (3) gooseflesh, (4) flavocellosis, and (5) glazed scab. Non-parasitic rind disorders seem generally to form the chief hindrance to the successful export of Valencia oranges. *Penicillium italicum* is stated to be comparatively unimportant on oranges, moulding generally being due to *P. digitatum*; *Phomopsis* [*Diaporthe*] *citri* is responsible for an appreciable amount of wastage in oranges from the coast of New South Wales.

In processing experiments with various materials in solution used against moulds on oranges borax invariably gave almost perfect control, even on fruits inoculated experimentally with *P. digitatum*, no other material tested giving comparable results. Recontamination of the fruit after treatment, however, results in wastage. When wounded, inoculated, and unwounded Washington Navel oranges were intermittently fumigated over a period of 7 weeks at 70° F. with nitrogen trichloride gas [ibid., xv, p. 576], controls being held without gas for a similar period, the treatment reduced wastage in the wounded and unwounded fruits by 76·2 and 58·5 per cent., respectively, but had no effect whatever on the inoculated fruits, which were completely wasty after six weeks' storage. The use of nitrogen trichloride for the immediate gassing of fruit on its reception at the packing shed should prove beneficial to the fruit and also, indirectly, in shed disinfection. The gas is, however, a dangerous explosive, and there is no likelihood of its immediate commercial release in Australia.

Valencia late oranges stored at 40° are susceptible to storage spot in the pre-climacteric stage, and for about three weeks after the climacteric. Control results from storage for 3 weeks at 50° before storing at 40°, or from delayed picking.

Su (M. T.). **Report of the Mycologist, Burma, Mandalay, for the year ended the 31st March, 1937.**—9 pp., 1937. [Received April, 1938].

The following are among the items of interest in this report [cf. *R.A.M.*, xvi, p. 154]. A fungus resembling *Helminthosporium* was isolated from the grains of XKF 7–81 rice plants with dark brown glumes and inoculated into the flowers of the same strain and XeF 7–53, producing discolorations on 96 per cent. of the grains in both, compared with an incidence of 6 per cent. in the uninfected controls, the symptoms on the latter strain being particularly reminiscent of those observed in nature.

Ustilaginoidea virens, the agent of false smut of rice [ibid., xvi, p. 231],

caused little damage at Hwambi during the period under review, in contrast to its high incidence in the previous year. In Quaker oats agar cultures the smut failed to grow at and above 34° C., whereas at 32·5° and 23·25° it grew 23 and 67·5 mm., respectively, within 46 days. The sclerotia of *U. virens*, after one year buried in the soil, were found to be reduced to a dark green, powdery mass of non-viable spores.

Considerable damage was caused at Madayo by the black stem disease of betel vines (*Piper betle*), associated with a species of *Gloeosporium*.

Diplodia natalensis was found to be the chief agent of decay in stored mangosteens (*Garcinia mangostana*) [ibid., xvi, p. 154], infection (53 and 25 per cent. in the pulp and stalks, respectively) probably taking place after plucking. *Phomopsis* sp. caused 28 and 14 per cent. pulp and stalk infection, respectively, while *Fusarium*, *Pestalozzia*, and *Gloeosporium* spp. were practically confined to the stalks. Fruits stored at 35° to 50° F. kept better than those held at 81° to 89°; a 1·5 per cent. formalin dip (15 minutes) checked decay at the latter but not at the former temperature, at which 30 minutes' immersion in 8 per cent. borax or wrapping in iodized paper were more successful.

A species of *Gloeosporium* with much larger spores than those of *G. ampelophagum* [*Elsinoe ampelina*] severely attacked vines in Mandalay and Kyauksè District, producing sunken spots on the twigs and eventually killing them. Good control was obtained by the excision of diseased material, followed by treatment with 1 per cent. Bordeaux mixture.

Sann hemp (*Crotalaria juncea*) at Pyinmana suffered appreciable damage from a *Fusarium* wilt [see above, p. 442].

Forty-ninth Annual Report of the Rhode Island State College Agricultural Experiment Station.—44 pp., 1937. [Received April, 1938.]

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xv, p. 705]. The damage frequently inflicted on tomato foliage by chemical sprays [ibid., xvi, p. 714] is generally intensified when environmental conditions are such that a protracted period is necessary for the liquid to dry, while insufficient available soil moisture is another important contributory factor. No differences in the stomatal behaviour of sprayed and unsprayed Ultropak tomato leaves could be discerned in trials with copper fungicides, and it is thought that the influence of spray films on transpiration may to some extent be explained by the permeability of the epidermis, which was shown by microchemical tests to be composed of undifferentiated cellulose.

The best control of apple scab [*Venturia inaequalis*] on the Baldwin, McIntosh, Rhode Island Greening, and Northern Spy varieties was given by an entire schedule of 1 in 40 lime-sulphur, which reduced the incidence of infection on the two first-named varieties from 22·74 and 53·23 to 1·81 and 3·12 per cent., respectively. Flotation sulphur paste (1 in 80) produced larger and brighter green leaves than the other treatments, but its relatively low toxicity to the scab fungus and tendency to cause russeting preclude its exclusive use.

Dusting spinach seed with copper oxide [against unspecified fungi: *R.A.M.*, xvii, p. 219] consistently increased the yield by from 34 to 100

per cent. in both spring and autumn crops; the same treatment also benefited beet, cucumber, and tomato seeds. The treatment of planting soil with formaldehyde or trioxymethylene dusts gave good results in the case of spinach, beet, cucumber, tomato, and peppers [*Capsicum annuum*].

All the mercury compounds, both organic and inorganic, that have been placed on the market for the control of brown patch [? *Corticium solani*: ibid., xii, p. 450; xvi, p. 468] and dollar spot [ibid., xv, p. 706; xvi, p. 681] of turf proved equally effective at 68° F. The same treatments may be recommended for the elimination of pink patch (*C. fuciforme*) [ibid., xvi, p. 468], the temperature range of which was found to lie between 8° and 30° C., with an optimum at 18° to 20°.

Fifty-fifth Annual Report of the Ohio Agricultural Experiment Station 1935–1936.—*Bull. Ohio agric. Exp. Sta.* 579, 139 pp., 12 figs., 3 graphs, 1937. [Received April, 1938.]

In the section of this report dealing with botany and plant pathology (pp. 34–42) [cf. *R.A.M.*, xvi, p. 440] H. C. Young states that the 1936 season was very unfavourable for the development of apple scab [*Venturia inaequalis*] in Ohio. Infection occurred only in the late delayed dormant stage, and was easily controlled with a 1 in 50 lime-sulphur spray, though wettable sulphur sprays and lime-sulphur 1 in 60 did not give complete control. Applications to be effective had to be made about 36 hours after infection had started, even with lime-sulphur 1 in 50. The results show that a slightly stronger mixture than that ordinarily used is necessary when rainy weather interferes with the exact timing of early sprays.

Young and H. F. Winter found that the adhesiveness of sulphur mixtures depends to a considerable extent on the amount of wetting agent used and that the addition to wettable sulphurs of very small quantities of colloidal materials such as gelatine or skim milk allows a great reduction in the amount of wetting agent required. The following formulae were satisfactory combinations: (1) aresklene [ibid., xvi, p. 196] 0·1 oz., gelatine 0·2 oz., and sulphur 5 lb.; (2) Grasselli wetting agent 2A 0·1 oz., gelatine 0·2 oz., and sulphur 5 lb.; (3) dry lime-sulphur 1 lb., and sulphur 4 lb.

Germination tests with the conidia of *Glomerella cingulata* indicated that only sulphur in the amorphous state was directly toxic, while colloidal sulphurs that are primarily crystalline were not toxic. Amorphous sulphur collected by vaporizing sulphur was toxic until it changed to a crystalline form.

Tests with the steam vapour application of fungicidal sprays [ibid., xvi, p. 696] in which the spray is heated to about 100 lb. pressure and applied as vapour showed that the method has the following advantages: the amount of spray material required for thorough coverage is reduced by about 75 per cent., cheaper materials can be used, and spray injury is lessened. The disadvantages are increased costs in fuel and time. The reduction in the cost of the spraying material equalizes the extra fuel expense, but the time factor remains. Tests with numerous common spray mixtures showed that wettable sulphurs were vaporized in fine particles, regardless of the original size of the particle, the

sulphur being vaporized in the amorphous state, sulphur and lime were vaporized as lime-sulphur very effectively, Bordeaux mixture was made safer but less fungicidal, and many insoluble copper compounds were rendered dangerous to foliage.

Winter found that satisfactory control of raspberry anthracnose [*Elsinoe veneta*: ibid., xv, p. 817; xvii, p. 121] resulted from one delayed dormant application of lime-sulphur, 1 in 10 to 1 in 30, whereas Bordeaux mixture (12–12–100), basic copper chloride, and coposil were unsatisfactory. The addition of a pre-blossom spray application in every case markedly reduced infection, even in the relatively dry season of 1936; Bordeaux mixture (4–8–100), basic copper chloride, and coposil were about equally effective when used as pre-blossom sprays. Lime-sulphur 1 in 50 caused serious foliage burning and stunting as a pre-blossom spray, and appears to be unsafe on black raspberries after the delayed dormant stage.

P. E. Tilford found that the causal organism of sweet pea fasciation (*Phytomonas fascians*) [ibid., xvi, p. 321] survives from one crop to the next mostly in the soil, the sterilization of which is the most important control measure. To a slight extent the organism appears to be borne on the outside of the seed coat of sweet peas, seed dusting with red copper oxide providing an effective treatment.

In spraying tests by J. D. Wilson and H. A. Runnels against *Alternaria* [*panax*] on ginseng [*Panax quinquefolium*: ibid., xii, p. 657] the results showed that a fungicide of low solubility, such as copper oxychloride, may give nearly as good control as Bordeaux mixture, if the former is used with a good spreader and sticker.

R. C. Thomas found that bacteriophages inhibiting growth and lysing homologous strains of *Apl*[*anobacter*] *stewarti* [ibid., xvi, p. 441] were generally present in field maize and in some of the hybrid varieties of sweet maize. They were not present in early pure-line strains of sweet maize, except occasionally in infected seed, which gave very few diseased plants. Whenever a plant showing typical symptoms recovered, a phage was associated with the infection. The seed of various grasses and cereal grains revealed the presence of the phage when water extracts were tested against two strains of *A. stewarti*.

Not one out of 200 raspberry plants propagated by Winter by the leafbud cutting method (each cutting consisting of a leaf with its axillary bud taken from the current year's cane) showed any sign of crown gall [*Bact. tumefaciens*: ibid., xiv, p. 219] after a year, though 50 per cent. of the plants in the parent planting were affected when the cuttings were made.

Smith (C. O.). **Crown gall on Taxus baccata.**—*Phytopathology*, xxviii, 2, pp. 153–154, 1 fig., 1938.

About 70 per cent. of the inoculations made at Riverside, California, with cultures of *Pseudomonas* [*Bacterium*] *tumefaciens* isolated from peach and *Libocedrus decurrens* [*R.A.M.*, xvii, p. 19] on one-year or older branches of a nursery specimen of European yew (*Taxus baccata* var. *erecta*) were successful. The galls produced were somewhat smaller than those usually formed by the organism on susceptible hosts.

BERTHELOT (A.) & AMOUREUX (GERMAINE). **Sur la formation d'acide indol-3-acétique dans l'action de Bacterium tumefaciens sur le tryptophane.** [On the formation of indol-3-acetic acid in the action of *Bacterium tumefaciens* on tryptophane.]—*C. R. Acad. Sci., Paris*, ccvi, 7, pp. 537–540, 1938.

The tumours induced by indol-3-acetic acid in young sunflower plants cultivated under aseptic conditions being analogous to those resulting from inoculation with *Bacterium tumefaciens* [*R.A.M.*, xvii, p. 224], experiments were conducted to determine whether the crown gall organism elaborates this substance in appreciable quantities. In a nutrient solution containing tryptophane *Bact. tumefaciens* was in fact observed to form substantial amounts of indol-3-acetic acid at the expense of the tryptophane, the reaction to hydrochloric acid with traces of perchloride of iron being well marked after 24 hours and increasing in intensity up to the fourth day. Evidently indol-3-acetic acid plays an important part in the etiology of crown gall tumours, and the suggestion is made that the immunity from the disease of certain plants is in part conditioned by their exceptionally low tryptophane content.

DILLON WESTON (W. A. R.). **A field observation on Ophiobolus graminis.** —*Ann. appl. Biol.*, xxv, 1, pp. 209–210, 1938.

As an illustration of the inadvisability of too frequent a recurrence of a crop in rotation schemes the case is cited of a field in Norfolk which, in 1933, had been sown to barley, followed in 1934 by sugar beet, in 1935 by wheat on one half of the field and oats on the other, and in the next year by barley over the whole of the field. In 1936, the barley on the half which had been under wheat had about 60 per cent. of the tillers infected with *Ophiobolus graminis* [*R.A.M.*, xvii, p. 230] and its yield was assessed at half a sack to the acre, whereas the yield on the half preceded by oats was estimated at from six to seven sacks per acre. In the light of Garrett's recent studies on take-all [ibid., xvi, p. 306; xvii, p. 230], it is suggested that either the half of the field following wheat had been infected in 1935 with air-borne ascospores of *O. graminis*, the pseudosaprophytic or declining phase of which persisted on the dead wheat roots, or the 1933 barley crop had been infected and the declining phase lingered over in the soil to the autumn of 1935 when barley was sown; on the other half of the field where oats preceded barley, the fungus was apparently unable to survive on the roots of this crop, and the barley was a success.

MACHACEK (J. E.) & GREANEY (F. J.). **The 'black-point' or 'kernel smudge' disease of cereals.**—*Canad. J. Res.*, Sect. C, xvi, 2, pp. 84–113, 1 pl., 1 graph, 1938.

In giving a comprehensive review of the literature dealing with the pathological discoloration of wheat, barley, and rye grains which has been described under the names 'black point' [*R.A.M.*, xiii, p. 759; xv, p. 433], 'moucheture' [ibid., xiv, p. 91], and 'puntatura' [ibid. xii, p. 160], the authors suggest the term 'kernel smudge' for the condition

characterized by a dark or light brown, diffuse discoloration caused by fungi in any part of the grain, and more particularly in the region of the embryo. Examination of samples of wheat grown in Winnipeg from 1929 to 1935 showed that the condition is prevalent and of economic importance in Manitoba, and that apparently *durum* wheats are more susceptible to it than *vulgare* varieties. It was further found [by a plating method which is briefly described] that the fungi chiefly associated in Manitoba with this condition are *Alternaria tenuis*, *A. peglionii* [ibid., xv, p. 209] *Helminthosporium sativum*, and *H. teres*. Extensive trials demonstrated that the *Alternaria* kernel smudge (which macroscopically is indistinguishable from the *Helminthosporium* type) does not affect to any marked extent the germinability of the affected seeds, the emergence of seedlings, intensity of foot rot, or yield of the subsequent crop, whereas *H. sativum* reduced germination, seedling emergence, and yield, and also increased the amount of foot rot.

Under Manitoba conditions it was shown that the cereal grains are infected by air-borne spores of the fungi; by means of spore-traps it was demonstrated that the largest numbers of such spores usually occur in the air about the time when the grains are maturing. Frequently the largest grains in the ear are infected while the small, shrunken ones are usually free from the condition, and this is apparently due to the fact that the large kernels force open their covering glumes, thus affording access to the spores, whereas the glumes of small kernels remain closed and exclude the spores.

In special tests it was established that dusting wheat seeds affected with the virulent type of kernel smudge (*H. sativum*) with a suitable organic mercury dust (e.g., ethyl mercury phosphate or methyl mercury nitrate) considerably increased their seed value, while dusting with copper carbonate was relatively ineffective. Dusting the growing wheat plants with sulphur did not prevent the development of the disease.

JOHNSON (T.) & NEWTON (MARGARET). **The origin of abnormal rust characteristics through the inbreeding of physiologic races of Puccinia graminis tritici.**—*Canad. J. Res.*, Sect. C., xvi, 1, pp. 38–52, 1 pl., 1938.

The inbreeding of physiologic races of *Puccinia graminis tritici* by means of the selfing of selected strains for several successive generations gave rise to strains showing various abnormal characteristics, namely, greyish-brown, orange, or white uredosori; decreased vigour of sporulation manifested by a tendency to form uredosori unable to rupture the epidermis of the wheat plant; decreased virulence; increased sensitivity to high temperatures; inability to produce aecidia on the barberry; and the development of uredosori and teleutosori on the barberry [*R.A.M.*, xvi, p. 520] by some strains that have, partially or entirely, lost the ability to produce aecidia. Many inbred strains showed no abnormal characteristics. It is suggested that the abnormal characteristics mostly result from the segregation and recombination in a homozygous state of recessive mutations occurring in the past history of the rust.

KOVACHEVSKY [KOVAČEVSKI] (I. C.). Медниятъ карбонатъ и употрѣблението му въ земедѣлието. Приносъ кѣмъ въпроса за борбата съ твърдата главня по Пшеницата. [Copper carbonate and its use in agriculture. A contribution to the problem of Wheat bunt control.]—41 pp., pamphlet issued by the Bulgarian Plant Protection Service, 1937. [English summary.]

In this paper the author gives an account of field trials from 1933 to 1936, inclusive, in Bulgaria, the results of which confirmed the efficacy of Borghardt's AB copper carbonate dust [*R.A.M.*, xiv, p. 47] in the control of wheat bunt (*Tilletia levis*) [*T. foetens*]. The preparation is relatively cheap and can be easily made by mixing two parts of ground copper sulphate with one of chalk and adding water. Its widespread use for the disinfection of wheat seed-grain in Bulgaria is strongly advocated.

HOUDAYER (C.). **Contribution à l'étude du traitement de la carie des Blés.** [Contribution to the study of Wheat bunt control.]—*Progr. agric. vitic.*, cix, 5, pp. 112–116, 1938.

The author states that extensive field trials in central France from 1934 to 1936, inclusive, showed that wheat grown from seed disinfected by sprinkling 100 kg. seed with 8 l. of a solution of potassium permanganate, 75 to 100 gm. per 100 l. water, was completely free from bunt [*Tilletia caries* and *T. foetens*], while control plots contained averages of from 2 to 7 bunted ears per sq. m. Besides its very low cost, the treatment has the further advantage over the similar treatment with 0·1 per cent. copper sulphate, that the seed treated with permanganate does not burst after sprinkling and its germination is advanced by four days, in comparison with that of the copper sulphate-treated seed.

VERESCIAGHIN (B. [V.]). О дезинфекціи сѣмянъ противъ мокрой, твердой и пыльной головни. [Disinfection of seeds against bunt, and loose and covered smuts.]—*Bul. agric. Basarabia, 1937*, 5, 2 pp., 1937.

The author points out that cereal seed grain disinfection against bunt (*Tilletia tritici*) [*T. caries*] and smuts (*Ustilago* spp.) has been rendered compulsory in Rumania by Order of the Ministry of Agriculture of 14th August, 1937, and briefly indicates the treatments applicable to the different diseases. The best control of wheat bunt is said to have been afforded by the old brand of porzol (of a reddish-brown colour, the new porzol, of a dark-purple colour being much less effective) [*R.A.M.*, xvi, p. 89] ceresan, and arzopol (Moscovitz); next in efficacy came anti-smut (Cooper), and cerealina (Caffaro).

HANNA (W. F.). **The association of bunt with loose smut and ergot.**—*Phytopathology*, xxviii, 2, pp. 142–146, 1 fig., 1938.

Kota wheat heads simultaneously infected by both *Ustilago tritici* and *Tilletia tritici* [*T. caries*] have been collected in the field at Winnipeg, Canada, and also produced in the greenhouse at the Dominion Rust Research Laboratory by artificial inoculation [*R.A.M.*, xvi, p. 239]. In the material examined, bunt has been confined to the upper, and loose smut to the lower part of the spike. Joint infection by *U. tritici*

and *T. caries* causes high seedling mortality; in greenhouse tests only 44 per cent. of the seeds inoculated with both smuts survived to maturity, as compared with 97 per cent. for the uninoculated controls. Competition between *U. tritici* and *T. caries* resulted in a marked suppression of infection by the latter.

On Little Club, Reward, Mindum, and Reward×Garnet wheat plants, bunt balls containing *T. caries* spores have been found fused to the projecting tips of ergot (*Claviceps purpurea*) sclerotia.

GREANEY (F. J.). **The effect of phosphate deficiencies on infection of Wheat by Fusarium culmorum.**—*Canad. J. Res.*, Sect. C., xvi, 1, pp. 27–37, 1 fig., 1938.

When Marquis wheat was grown for 36 days in pot cultures of quartz sand with different types of manuring, including a fully manured control and four series deficient in phosphate, one-half of the pots being inoculated with *Fusarium culmorum* [*R.A.M.*, xvii, p. 229] and sown with inoculated seed, the remainder serving as uninoculated controls, the results obtained [which are tabulated] showed that phosphate deficiencies did not significantly affect susceptibility to infection, though they significantly reduced root development and the total dry weight of the plants. Some indication was obtained, however, that high concentrations of phosphate tend to predispose wheat plants to infection. The results suggest that phosphates exert a much greater effect on plant growth and yield than on the severity of infection by *F. culmorum*.

VOLK (A.). **Biologie und Bekämpfung der Typhulafäule an Wintergerste.** [Biology and control of the *Typhula* rot of winter Barley.] —*Kranke Pflanze*, xv, 2, pp. 23–27, 5 figs., 1938.

This is an abridged version of the writer's studies on the rot of winter barley in Germany caused by *Typhula graminum*, a fuller account of which has already been noticed from another source [*R.A.M.*, xvi, p. 802].

REED (G. M.) & STANTON (T. R.). **Inheritance of resistance to loose and covered smuts in Markton hybrids.**—*J. agric. Res.*, lvi, 3, pp. 159–175, 3 figs., 1938.

A detailed account is given of experiments in which the authors studied the reaction to Missouri races of *Ustilago levis* [*U. kolleri*] and *U. avenae* [*R.A.M.*, xvii, p. 234] of hybrids resulting from crosses between Markton oats, highly resistant to both smuts, on the one hand, and on the other, the varieties Canadian, Early Champion (and its reciprocal), and Victor, all susceptible to both smuts, Gothland, susceptible to the loose and resistant to the covered smut, and Monarch, susceptible to the covered and resistant to the loose smut. In F_2 plants of the three first-named crosses artificial inoculation with *U. avenae* resulted in low percentages (8·6 to 16) of infection, higher percentages (20 to 32·5) being obtained with *U. kolleri*. F_3 populations inoculated with both smuts showed no agreement in their reaction to the smuts. These results may suggest a two-factor difference in the oat varieties in

respect of loose smut and a single-fact or difference in respect of covered smut. In both the F_2 and F_3 generations there was a noticeable lack of progenies fully susceptible to the two smuts. F^3 plants of hybrid 56, Gothland×Markton, inoculated with loose smut gave 17·1 per cent. infection, and 72·6 per cent. of the F_3 progenies descended from uninoculated F_2 plants were segregating, the others being resistant. No completely susceptible progenies were observed. A few of the F_2 plants and some of the F_3 progenies were infected with covered smut. Of the F_2 plants of hybrid 60, Monarch×Markton, 22 per cent. became infected when inoculated with covered smut, and 74·4 per cent. of the F_3 progenies descended from uninoculated F_2 plants contained smutted individuals. These data suggest a single factor difference, although there is a noticeable lack of susceptible F_3 progenies. A few of the F_2 plants inoculated with loose smut were infected and smutted plants were also found among several F_3 progenies.

Marchionatto (J. B.). **Argentine Republic: 'fermented' Maize ears and control measures.**—*Int. Bull. Pl. Prot.*, xii, 2, pp. 25–26, 1938.

The writer reports the occurrence of *Diplodia zeae* on maize ears in the province of Buenos Aires, Argentine Republic, briefly describes the symptoms of infection, and indicates control measures. Surveys at maize storage centres indicate that the disease is not very extensively distributed, and in the most serious outbreaks, in Pergamino, only affected 2 per cent. of the crop. In commerce affected grain is known as 'fermented' seed.

Mains (E. B.). **Two unusual rusts of grasses.**—*Mycologia*, xxx, 1, pp. 42–45, 1 pl., 1938.

After briefly referring to a recent paper, in which he erected the genus *Angiopsora* for a group of rusts with catenulate teleutospores on grasses (*Mycologia*, xvi, pp. 122–132, 1934), the author describes [with Latin and English diagnoses] under the name *A. zeae* n.sp. a rust collected on maize in Guatemala and also reported from Porto Rico and Trinidad. It is characterized by sessile, obovoid or ellipsoid, hyaline or yellowish uredospores, 22 to 34 by 16 to 20μ, and angularly ellipsoid or oblong, golden-brown, catenulate teleutospores in rows of one to three (usually two), measuring 16 to 38 by 12 to 18μ. Macroscopically it differs from the widespread maize rust (*Puccinia sorghi*) [*P. maydis*: *R.A.M.*, xvi, p. 19] in that its teleutosori remain covered by the epidermis, and in the light yellow colour of its uredosori.

P. apoda Har. & Pat. on *Pennisetum setosum* is referred to the genus *Phakopsora* under the name *P. apoda* comb. nov., and a revised English description of the fungus is appended.

Johnston (C. O.), Lefebvre (C. L.), & Hansing (E. D.). **Observations on the loose kernel smut of Johnson Grass.**—*Phytopathology*, xxviii, 2, pp. 151–152, 1 graph, 1938.

The smut infecting Johnson grass (*Sorghum halepense*) in Kansas and Oklahoma in 1935 and 1936, respectively, was identified by G. L. Zundel as most closely resembling *Sphacelotheca holci*, described by

H. S. Jackson on specimens of sorghum collected by C. E. Chardon and collaborators in Venezuela (Mycological explorations, 1934) [*R.A.M.*, xiv, p. 397]. The differences between *S. holci* and the loose kernel smut, *S. cruenta*, a new physiologic race of which on Johnson grass has recently been reported by H. A. Rodenhiser [loc. cit.], are of the same order as those between separate species of certain other smuts, e.g., those of oats [*Ustilago avenae* and *U. kolleri*], but are less sharply defined than those characterizing various physiologic races of *T. tritici* [*T. caries*: ibid., xv, p. 287; xvii, p. 381]. The chlamydospores of *S. holci* are larger, more prominently echinulated, and somewhat darker than those of *S. cruenta*, while the sporidia and promycelia of the former are also longer than those of the latter. Smutted Johnson grass plants are stunted, profusely tillered, and branched, forming panicles prematurely. The sori of the smut are characterized by early peridial fragmentation and the presence of a long, prominent columella. These features, together with the similarity of the spores, point to a relationship between the Johnson grass smut and *S. cruenta*, but the failure of the former to infect many species of cultivated sorghum denotes a somewhat distant connexion.

Melchers (L. E.) & Hansing (E. D.). **The influence of environmental conditions at planting time on Sorghum kernel smut infection.**—*Amer. J. Bot.*, xxv, 1, pp. 17–27, 6 graphs, 1938.

In field studies conducted over a period of five years at Manhattan, Kansas, plantings of sorghums were made at weekly intervals to determine the relationship of environmental factors to infection by kernel smut (*Sphacelotheca sorghi*) [*R.A.M.*, xvi, p. 666]. Reaction to this smut can best be determined by planting from 10 to 14 days earlier than usual, since early planting prevents the plants from escaping smut. The results substantiated those obtained by Reed and Faris in the greenhouse [ibid., iv, p. 158]. Soil temperature and soil moisture are interdependent factors in determining the infection of sorghum by kernel smut. Medium to low soil temperatures with medium to low soil moistures appeared to be most conducive to maximum infection. Moderate infection occurred over a very wide range of soil temperatures and soil moistures. Heavy infection occurred at all temperatures under 75° F. which permitted seed germination, low soil temperatures being consistently associated with high infection. A minimum of 28° during the infection period in no way hindered infection. As a general rule, infection was reduced when the mean maximum soil temperatures during the infection period were 75° or over, though during the germination and infection periods one or two high temperatures may inhibit infection, even when the average of the maximum temperatures does not appear adverse to infection under field conditions. Soil moistures of 28 per cent. or more on the dry basis considerably reduced infection, even under favourable soil temperature conditions. Soil moistures of under 8 or 10 per cent. on the dry basis appeared to reduce infection, but when the soil moisture remains at this point sorghum seed does not germinate. When soil moisture, after rain, becomes high enough for germination, some infection may occur, i.e., infection can take place in any degree of soil moisture in which sorghum seed will germinate.

MEHTA (P. R.) & CHAKRAVARTY (S. C.). **A new disease of Eleusine coracana Gaertn.**—*Indian J. agric. Sci.*, vii, 5, pp. 793–796, 6 figs., 1937. [Received May, 1938.]

A new disease of *Eleusine coracana* is reported from Benares. The affected plants were stunted, pale, and tufted in appearance, often produced very short internodes, and formed numerous sterile lateral shoots from the upper nodes and abundant white adventitious roots from the aerial nodes. Tillering and length of life were, however, normal. Although *Piricularia* spp. were isolated from numerous lesions of the leaf blades of younger plants and microscopic examination revealed the presence of bacteria in the intercellular spaces of some of the discoloured patches of the phloem of root and stem, rarely in the cells themselves, the exact cause of the disease has not yet been determined. The disease was first observed in a plot with somewhat defective drainage.

BAKER (R. E. D.). **Citrus scab disease on Grapefruit in Trinidad.**—*Trop. Agriculture, Trin.*, xv, 4, pp. 77–79, 1938.

Citrus scab caused by *Elsinoe fawcetti*, first observed in quantity on Marsh grapefruit trees in Trinidad, in January, 1937 [*R.A.M.*, xvi, p. 527], was deduced from the age of the diseased leaves to have appeared first on the grapefruit in October or November, 1936. Further outbreaks have occurred since then whenever weather conditions have been suitable, and although the infected area is to leeward of many big estates and the spread of infection by the wind may therefore be slow, it is expected that it will almost certainly invade other areas in the course of time. The risk of spreading the disease through the exchange of field boxes in the central packing-house should be minimized by careful disinfection of the boxes. Temperature and humidity records kept on the affected estate for a period of nine months show that weather conditions suitable for scab infection of leaves and fruits occurred only four or five times during 1937.

The Trinidad 'grapefruit strain' of the fungus appears to differ slightly from the other Trinidad isolations. A series of cross-inoculations of grapefruit and sour orange, carried out in the laboratory and in the field and repeated several times with consistent results, proved that the strains from each of them were only capable of attacking their own host; a 'rough lemon strain' of the fungus was also unable to attack grapefruit. The results of these experiments, supported by field observations and the study of the fungus in pure culture, leads to the conclusion that the 'grapefruit strain' is a recent mutation from the 'sour orange strain'. Under Trinidad conditions spraying against the disease will be difficult and costly, but experiments in this connexion have been instituted.

BITANCOURT (A. A.). **A rubellose.** [Pink disease.]—*Biologico*, iv, 1, pp. 17–18, 1 fig., 1938.

A popular account is given of pink disease (*Corticium salmonicolor*) of citrus [*R. A. M.*, xvi, p. 451] and other fruit trees, which is stated to be fairly prevalent in Brazil. The trouble may be easily controlled by

carefully cutting out all infected branches and twigs as soon as the first symptoms appear, but neglect may lead to the partial or total death of whole trees. The pruning wounds should be immediately dressed with Bordeaux paste.

Progress Reports from Experiment Stations, season 1936–1937.—129 pp., 1 plan, 4 graphs, London, Empire Cotton Growing Corporation, 1938.

These reports [cf. *R.A.M.*, xvi, p. 455] contain, *inter alia*, the following items of interest. At Barberton, South Africa, some blocks of cotton were badly damaged by *Alternaria* [cf. ibid., viii, p. 306; xi, p. 638]. The premature leaf fall caused by the fungus has not previously seriously affected the local yields, the disease generally appearing too late in the season, and being mainly associated with very early strains that have matured their crop, or with cotton on poor soil.

There would appear to be a close connexion between maize streak [ibid., xvii, p. 160] and the distribution of the early rains in S. Africa. In the preceding season, when the spring rains were light and very late, there was very little streak throughout the season, but in 1936–7, when the rains arrived very early and were abundant, infection was of unprecedented severity, and plantings of susceptible strains made early in December developed about 66 per cent. infection by the end of January. A field of American White Flint maize planted on 31st December was very badly attacked, only 23 out of 21,300 plants being unaffected at a count made in February. Out of the 20 best selections of the variety Peruvian nine had not one infected plant.

Blackarm [*Bacterium malvacearum*: ibid., xvii, pp. 35, 239] of cotton was general but not severe in the Gezira area of the Anglo-Egyptian Sudan, where leaf curl [ibid., xvi, p. 175] development was slow on Sakel, and almost non-existent on X. 1530. Details are given of further progress in breeding work against *Bact. malvacearum* [ibid., xvii, p. 315] at Shambat and Serere. In tests against wilt [*Verticillium dahliae* and *Fusarium* spp.: ibid., xvii, pp. 295, 392] seven American varieties resistant to wilt in their country of origin failed to show complete resistance in Uganda.

The death of a few patches of cotton early in the season in Nyasaland was associated with *Macrophomina phaseoli*.

In St. Vincent, West Indies, rain fell on 28 days in January, 1937, with resultant high incidence of cotton boll rot (*Phytophthora* spp.) [ibid., x, p. 102] and blackarm.

Morrow (Marie B.), Roberts (J. L.), Adams (J. E.), Jordan (H. V.), & Guest (P.). **Establishment and spread of molds and bacteria on Cotton roots by seed and seedling inoculation.**—*J. agric. Res.*, lvi, 3, pp. 197–207, 4 diags., 1938.

In these studies [a brief reference to which has been noticed from another source: *R.A.M.*, xvii, p. 172], the authors show that the three moulds *Aspergillus luchuensis*, *Penicillium luteum*, and *Trichoderma lignorum*, already proved in the laboratory to be antagonistic to *Phymatotrichum omnivorum*, became established and apparently multiplied in the rhizosphere of cotton plants in experimental plots

artificially inoculated with these organisms, though *Penicillium luteum* was also isolated from uninoculated soil. The results of parallel tests with the antagonistic bacteria *Pseudomonas fluorescens* and *Achromobacter* [*Bacterium*] *radiobacter* were considered to be uncertain, because of the poor recovery of these organisms from the rhizospheres.

WATKINS (G. M.). **Cytology of Phymatotrichum root rot of Cotton seedlings grown in pure culture.**—*Amer. J. Bot.*, xxv, 2, pp. 118–124, 21 figs., 1938.

Roots of cotton seedlings grown aseptically and inoculated with *Phymatotrichum omnivorum* [*R.A.M.*, xvi, p. 454, and preceding abstract] in pure culture were gradually covered by a dense weft of fungous hyphae. Sections of roots fixed at 24-hour intervals showed that roots coming into contact with the cut surface of the sclerotium, or agar discoloured by a sclerotium, are usually inhibited in growth and occasionally develop sunken necrotic areas even before being attacked by hyphae. The agglomeration of hyphae over the root either brings about the death of the epidermis and cortex down to the central cylinder or single hyphae penetrate the epidermis and ramify through and between the cells of the cortex, endodermis, pericycle, and ultimately in the tracheids of the xylem. While the penetration process may conceivably involve a combined mechanical and chemical activity on the part of the fungus, the cytological evidence indicated a dominant part played by enzymic exudates. As far as has been observed, no symbiotic association of fungus and living host cells took place and moribund root cells were frequently seen as much as four cell layers from the fungus. No evidence was seen of the 'mechanical wedge' type of penetration [ibid., vi, p. 227] which has been reported by various other authors from field experiments.

KATSURA (S. K.). **Inoculation of young Cicada nymphs with spores of green muscardine disease.**—*J. econ. Ent.*, xxxi, 1, pp. 124–125, 1 fig., 1938.

Nymphs of the periodical cicada (*Magicicada septendecim*) on peach twigs from Virginia trapped at Maryland University in Petri dishes containing damp soil contaminated with the spores of *Metarrhizium anisopliae* [*R.A.M.*, xvii, p. 36] mostly succumbed in 15 to 24 hours, while those in a control plate on sterile, moist filter paper survived for the normal period of 4 to 15 days. The white, cottony mycelium of the fungus began to develop profusely on the bodies of the insects four to five days after inoculation.

JOHNPULLE (A. L.). **Temperatures lethal to the green muscardine fungus, Metarrhizium anisopliae (Metch.) Sorok.**—*Trop. Agriculturist*, xc, 2, pp. 80-83, 1 graph, 1938.

In laboratory tests [details of which are given] spores of *Metarrhizium anisopliae* [see preceding abstract] isolated from coco-nut beetle (*Oryctes rhinoceros*) larvae were shown to germinate at temperatures below 48° C. It is possible therefore that the fungus may be used for the biological control of the beetle in compost pits laid down on coco-nut land, since the temperature within the pits falls to well below 48°

about six weeks after laying down, when the compost can be safely inoculated with the organism.

SPARROW (F. K.). **The morphology and development of Obelidium mucronatum.**—*Mycologia*, xxx, 1, pp. 1–14, 44 figs., 1938.

A detailed account is given of the author's studies on the morphology and development of *Obelidium mucronatum* found in submerged exuviae of midges [Chironomidae] and caddis flies [Phryganeidae] in the vicinity of Ann Arbor, Michigan [*R.A.M.*, xvii, p. 173].

LINFORD (M. B.) & YAP (F.). **Root-knot injury restricted by a nematode-trapping fungus.**—Abs. in *Phytopathology*, xxviii, 1, pp. 14–15, 1938.

In a comparative experiment [? in Hawaii] pineapples were cultivated over a period of 15 months in steamed soil (A and B) without nematodes, (C and D) with *Heterodera marioni*, (E and J) with nematodes plus six isolates of nematode-trapping Hyphomycetes [*R.A.M.*, xvii, p. 318] grown in a nutrient-bagasse medium. Nematode infestation diminished pineapple top growth by 40, 34, and 28 per cent. without bagasse, with bagasse, and with bagasse plus *Dactylella ellipsospora*, respectively, the corresponding reductions in total root length amounting to 73, 69, and 57 per cent., respectively. Reisolations from galled roots showed that the experimentally introduced trapping fungi remained dominant during the period covered by the tests.

SOUCHARD & NGUYEN-VAN-HUONG. **La piedra noire en Cochinchine.** [The black 'piedra' in Cochin-China.]—*Ann. Parasit. hum. comp.*, xv, 6, pp. 539–543, 3 figs., 1937.

A brief account is given of morphological and cultural studies, the results of which showed that the nodules which are frequently found on the hairs of natives in Cochin-China, French Indo-China, are caused by a fungus apparently identical with *Piedraia hortai* [*R.A.M.*, xiii, p. 513] as judged from Horta's description of the Brazilian organism. This is stated to be the first known record of the fungus in Indo-China.

BALDACCI (E.). **Contributo alla sistematica degli Attinomyceti. I. Sull'Actinomyces bovis Harz e sull'Actinomyces sulphureus Gasp.** [A contribution to the systematics of the Actinomycetes. I. *Actinomyces bovis* Harz and *A. sulphureus* Gasp.]—*Atti Ist. bot. Univ. Pavia*, Ser. IVa, ix, pp. 243–271, 2 figs., 1937. [Latin and English summaries.]

This is an expanded account of work already noticed from other sources [*R.A.M.*, xv, p. 650; xvi, p. 774].

GERMAIN (A.) & MORVAN (A.). **A propos du diagnostic du rhumatisme cérébral; méningo-encéphalite aiguë à 'Torulopsis histolytica'.** [On the diagnosis of cerebral rheumatism; acute meningo-encephalitis due to *Torulopsis histolytica*.]—*Bull. Soc. méd. Hôp. Paris*, Sér. 3, liv, 5, pp. 231–234, 1938.

Clinical details are given of a fatal case of acute meningo-encephalitis in a 19-year-old naval gunner in France, associated with the presence in the spinal fluid of the circular, yeast-like cells of *Torulopsis histolytica*

[*Debaryomyces neoformans* or *Cryptococcus hominis*: *R.A.M.*, xvii, p. 394].

GOUGEROT (H.), GIRAUDEAU, & PATTE (A.). **De l'utilité de la lumière de Wood en dermatologie.** [On the utility of Wood's rays in dermatology.]—*Bull. Soc. franç. Derm. Syph., 1938*, 2, pp. 345–350, 1938.

Details are given of the writer's experiments in France on the application of Wood's rays [*R.A.M.*, xvii, p. 175], with eminently satisfactory results, to the diagnosis, prognosis, and therapy of miscellaneous human dermatoses, including pityriasis versicolor (*Malassezia furfur*) [ibid., xvii, p. 243].

SIMON (F. A.). **Allergic conjunctivitis due to fungi.**—*J. Amer. med. Ass.*, cx, 6, p. 440, 1938.

The following evidence is adduced in support of the writer's conclusion that air-borne fungal spores were the chief etiological factor in a case of conjunctivitis in a 38-year-old man at Louisville, Kentucky. Seasonal variations in the symptoms coincided with similar changes in the atmospheric concentration of fungus spores. The trouble was consistently relieved during the patient's absence from the particularly humid conditions of his place of residence, from the air of which fungi were cultured in abundance. Skin tests with *Alternaria* and *Cladosporium* extracts were definitely positive [cf. *R.A.M.*, xvii, p. 243], and the clinical features of the disturbance were reproduced by the application of the *Alternaria* extract to the conjunctiva, a control test on a non-sensitive subject being negative. Desensitization with fungus extracts resulted in a pronounced improvement in the patient's condition.

JOLTRAIN (E.). **Aspergillose pulmonaire primitive et pure évoluant depuis 15 ans.** [Primary and pure pulmonary aspergillosis of 15 years' duration.]—*Bull. Soc. Méd. Paris*, cxli, 8, pp. 327–337, 2 figs., 1937. [Abs. in *Bull. Inst. Pasteur*, xxxvi, 8, pp. 431–432, 1938.]

Clinical details are given of an illness of 15 years' duration simulating pulmonary tuberculosis and progressively involving the heart of a female patient in Paris. The sole organism obtained in pure culture from the sputum, however, proved to be *Aspergillus fumigatus* [*R.A.M.*, xvi, pp. 456, 611], injections with an alcoholic extract of which induced positive skin reactions. A marked distinctive feature of the case was the vivid red coloration of the bronchi.

WOLLENWEBER (H. W.) & KRÜGER (E.). **Die Septoria- oder 'Pasmo'-Krankheit des Leins in Deutschland.** [The *Septoria* or 'pasmo' disease of Flax in Germany.]—*NachrBl. dtsch. PflSchDienst*, xviii, 2, pp. 11–12, 1938.

Six out of 21 samples of German-grown flax from experimental plots examined at Dahlem, Berlin, towards the end of 1937 were found to be contaminated by *Septoria linicola*, the agent of the 'pasmo' (spasm) disease originally described from the Argentine and recently found on

material received from Belgrade [*R.A.M.*, xvi, p. 676]. Since it is not to be expected that the fungus will remain confined to the test plantings on which it originated, further investigations on the disease, and particularly the manner of its dissemination, are urgently required.

MAMELI-CALVINO (EVA). **Rassegna dei casi fitopatologici osservati nel 1937.** [Review of phytopathological observations in 1937.]—*Costa azzur. agric.-flor.*, xviii, 1–2, pp. 11–17, 1 fig., 1938.

Notes are given on a large number of plant diseases (chiefly of flowers and fruit) observed during 1937 on the Italian Riviera [cf. *R.A.M.*, xv, p. 22; xvi, p. 463], including *Bacterium solanacearum* on dahlias [ibid., xiii, p. 495], causing the stems to wither to a height of 5 to 7 cm. from the collar, followed by a sudden wilt of the plants, and *Bact. matthiolae* on *Matthiola incana* [ibid., xiii, p. 306] producing green, later brown, irregular spots on the leaves and stems, infection spreading to the roots, and the plants quickly dying. The latter disease was to some extent controlled by treatment of the affected plants with 0·03 per cent. cerere.

BEWLEY (W. F.). **Recent work on Rose diseases.**—*Sci. Hort.*, vi, pp. 97–101, 1938.

A survey is given of recent work at Cheshunt on the rose diseases caused by *Coniothyrium rosarum* [*Leptosphaeria coniothyrium*: *R.A.M.*, xv, p. 653], black spot (*Diplocarpon rosae*) [loc. cit.], rust (*Phragmidium* sp.) [ibid., xvi, p. 726], and mildew (*Sphaerotheca pannosa*) [loc. cit.].

BRIERLEY (P.) & MCKAY (M. B.). **Experiments with aphids as vectors of Tulip breaking.**—*Phytopathology*, xxviii, 2, pp. 123–129, 1938.

Both the 'colour-removing' and 'colour-adding' viruses (tulip viruses 1 and 2 respectively) of tulip breaking [*R.A.M.*, xii, p. 292; xiii, p. 446] were shown by experiments at the Oregon Agricultural Experiment Station from 1926 to 1930 to be transmissible by *Myzus persicae* and *Macrosiphum solanifolii*, but earlier reports as to the ability of *Myzus solani* to convey the disease from infected to healthy plants were not confirmed. In one test *M. circumflexus* was apparently instrumental in the transmission of breaking, but evidently neither of the bulb-infesting species, *Anuraphis tulipae* and *Rhopalosiphoninus tulipaella*, was concerned in the spread of infection. In none of the experiments did breaking symptoms develop during the season of inoculation.

WHITE (H. L.). **Stem rot and wilt of the perpetual flowering Carnation.**—*Sci. Hort.*, vi, pp. 86–92, 1938.

Notes, based on studies conducted at Cheshunt Experimental and Research Station from 1925 to 1928 and in 1934–35, are given on the mode of infection and control of carnation stem rot (*Fusarium culmorum*) and the wilt caused by *Verticillium cinerescens*. Most of the information given has already been noticed in this *Review* [cf. xv, p. 654; xvi, p. 726].

BROWN (W.). **Stem-rot and wilt of the perpetual flowering Carnation.**—*Sci. Hort.*, vi, pp. 93–97, 1938.

This is a popular account of the carnation diseases caused by *Fusa-*

rium culmorum, *F. dianthi*, and *Verticillium cinerescens* and their control [*R.A.M.*, xvii, p. 182; and preceding abstract].

Fischer (R.). **Beobachtungen über die Anfälligkeit der Chrysanthemum-Sorten.** [Observations on the susceptibility of Chrysanthemum varieties.]—*Blumen- u. PflBau var. Gartenwelt*, xlii, 8, p. 88, 1938.

With reference to Böhmig's recent observations on the reaction of chrysanthemums to rust [*Puccinia chrysanthemi*], *Septoria* [? *chrysanthemella*], and mildew [*Oidium chrysanthemi*] in Germany [*R.A.M.*, xvii, p. 181], the writer contributes the following notes on the susceptibility of some standard varieties at a Berlin municipal garden. (1) Large-flowered: H. E. Converse is very slightly and Princess v. Zehlendorf and Red Majestic slightly attacked by mildew, to which La Cagouille, Mme. Bringuier, and Jenkins are highly susceptible, susceptible, and fairly susceptible, respectively. Bernea, La Cagouille, and Mrs. R. C. Pulling are resistant to rust and to the *Septoria*, while D'Aubigny, Jenkins, Dr. Stresemann, and Red Majestic are highly susceptible, susceptible, susceptible and moderately susceptible, respectively. (2) Small-flowered: Perle v. Vierlanden, Ada Owen, and Majumbo are all liable to severe infection by rust and *Septoria*, the first-named, however, escaping under late propagation conditions. Blanche Poitevine, Hammelfänger, Pink Profusion, Rolf Curtis, and Rosenelfe are all susceptible to both diseases (the first-named, however, is not attacked in the open), while Ilse Wolf is resistant.

Campbell (Marie E.). **A disease of the Viola caused by Ramularia deflectens.**—*Ann. appl. Biol.*, xxv, 1, pp. 115–121, 1 pl., 2 figs., 1938.

Morphological and cultural studies of the fungus forming dark-coloured lesions, starting at the edge and gradually spreading inwards, on the leaves of Kate Blyth violas received in 1934 from Coventry, showed that the organism agreed in every respect with Lindau's description (1907) of *Ramularia deflectens* Bres., except in the size of the conidia which varied from 6·9 to 24·1 by 2·2 to 3·4 μ in diameter, as against 18 to 40 by 5 to 7 μ given in the diagnosis; a tendency was observed for the conidia produced on artificial infections on the host to be larger than those formed in culture. Immediately below the epidermis the leaves bore spherical to flask-shaped sclerotium-like bodies, 30 to 70 μ in diameter, the larger ones showing hyphae with small spores attached to their ends protruding from a definite papilla which projected through the ruptured epidermis; from comparison with pycnidia developed in pure culture on certain nutrient media, these bodies are considered to be true pycnidia which have not developed fully. Perithecia were found neither on the host nor in culture, but the presence of the pycnidia seems to warrant the withdrawal of the fungus from the Moniliales. Infection experiments in August, 1934, on two varieties of viola gave negative results, but were successful on the Kate Blyth variety in February, 1935, indicating that *R. deflectens* is a weak parasite attacking violas in early spring.

Canonaco (A.). **Una malattia del Tropaeolum majus L. dovuta ad un Ifale del genere 'Oidiopsis' Scal.** [A disease of *Tropaeolum majus* L. due to a Hyphomycete of the genus '*Oidiopsis*' Scal.]—*Lav. Ist. bot. Palermo*, viii, pp. 31–46, 1 pl., 1 fig., 1937.

Tropaeolum majus plants at Palermo have been affected for three successive years by a fungus, morphologically identical with *Oidiopsis sicula* [? *O. taurica*: *R.A.M.*, xi, pp. 281, 605], which produces small, yellow spots on the upper surface of the leaves with a powdery mass of conidiophores and conidia on the under surface. After a few days, the spots turn reddish-violet, but subsequently dry up, only the edges remaining coloured. The lesions are very numerous (up to 50 per leaf), irregularly shaped, and generally 4 to 6 mm. in diameter ($1\frac{1}{2}$ cm. when confluent). On some leaves most of the spots are arranged along the margins, which roll up, causing the leaf to become cup-shaped. Infection begins on the lower surface, and the mycelium, which bears globose haustoria, penetrates into the palisade tissue. In 1936, probably owing to the preceding mild winter, spotting was sparse, and most of the affected leaves showed a diffused chlorosis.

Wenzl (H.). **Oidium tuckeri Berk. auf Parthenocissus tricuspidata Planch.** [*Oidium tuckeri* Berk. on *Parthenocissus tricuspidata* Planch.]—*Z. PflKrankh.*, xlviii, 2, pp. 57–59, 1 fig., 1938.

Oidium tuckeri [*Uncinula necator*] was detected on the yellowish-brown, necrotic areas on Virginia creeper (*Parthenocissus tricuspidata*) foliage in a private garden in Vienna, where the discoloration, accompanied by extensive defoliation, was first observed at the end of May, 1936. Although causing appreciable damage to its host, the fungus was poorly developed, the superficial mycelium being invisible to the naked eye, and the production of conidia scanty. This is believed to be the first record of the true mildew of vine on *P. tricuspidata*.

Dodge (B. O.). **A further study of the dry-rot disease of Opuntia.**—*Mycologia*, xxx, 1, pp. 82–96, 4 pl., 1 fig., 1938.

Further studies of the dry rot of an unidentified species of *Opuntia* from New Mexico, recently described by the author [*R.A.M.*, xvi, p. 816], showed that the invasion of the host by the fungus is at first fairly rapid, but is later stopped by the formation of a callus layer cutting off the healthy tissue. The only fruiting bodies so far found are minute pycnidium-like structures which may possibly be spermogonia, and the cavities of which are developed in stromatic tissue through disorganization. It is possible that Seaver based his *Phyllosticta concava* (*N. Amer. Flora*, vi, p. 13, 1922) on this or a similar organism, and it is suggested that it be referred to provisionally under the name *P. concava*, although the fruiting body is not that of a typical *Phyllosticta*. Diseased specimens of *O. dillenii* sent by J. M. Waterston from Bermuda bore three or four different types of fruiting bodies, the most common of which is described [with a Latin diagnosis] as *Leptodermella opuntiae* n.sp.; it has pinkish, fleshy pycnidia at first subgloboid, 100 to 170 μ in diameter, and non-ostiolate; filiform conidiophores; and hyaline, unicellular conidia, 3 to 4·5 by 1 to 1·5 μ. Four of the specimens show

perithecia which may belong to a *Mycosphaerella*, and two bore large numbers of *P. concava* pycnidia.

GREGOR (MARY J. F.). **Associations with fungi and other lower plants.**—*ex* Manual of Pteridology (ed. F. Verdoorn, The Hague, Holland, M. Nijhoff), pp. 141–158, 2 figs., 1938.

This is a comprehensive, fully documented summary of our knowledge of the diseases of ferns, Equisetinae, and Lycopodiinae, caused by fungi, Myxomycetes, bacteria, nematodes, and viruses.

CHITTENDEN (E.) & THOMSON (R. H. K.). **The effect of borax top-dressing on the storage quality of Jonathan Apples.**—*N.Z. J. Sci. Tech.*, xix, 9, pp. 541–546, 1 fig., 1 graph, 1938.

Particulars are given of experiments on a block of 48 Jonathan apple trees on a poor soil phase of the Moutere Hills, Nelson, New Zealand, to determine the effect of borax top-dressings, as applied for the control of internal cork [*R.A.M.*, xvii, p. 255] at rates of $\frac{1}{2}$, 1, and 3 lb. per tree, on the keeping quality of the fruit in storage at 38° F.

It was found that, after six months in storage, the incidence of internal breakdown was appreciably increased even by the $\frac{1}{2}$ lb. treatment (35 as compared with 11 per cent. in the controls), the corresponding figures for the 1 and 3 lb. applications being 57 and 81 per cent., respectively. Fungal rots [unspecified] also increased on a roughly parallel scale, amounting to 6, 23, and 41 per cent., respectively, for the three borax treatments compared with 1 per cent. in the controls. Under the somewhat heavy local rainfall conditions the trees were found to have absorbed relatively large quantities of boron, namely 30, 80, and 111 p.p.m. in samples from the three treatments, corresponding to 21, 45, and 71 per cent. internal breakdown and to 6, 23, and 41 per cent. fungal rots, respectively; the controls showed 7 and 1 per cent., respectively, of breakdown and decay and contained 17 p.p.m. boron.

It is apparent from these data that the maximum spring borax dressing for Jonathans, even on soils liable to serious internal cork, should not exceed $\frac{1}{2}$ lb. per tree. Further evidence to the same effect was received, subsequent to the preparation of this paper, from W. R. L. Williams, of Alexandra, who found the fruit from ten Ballarat seedling apples treated with $\frac{2}{3}$ lb. borax per tree in a very poor condition in October after storage since May. Eleven of the apples examined at the Cawthron Institute showed severe internal breakdown and fungal rot, and contained 53 p.p.m. boron.

CARNE (W. M.) & MARTIN (D.). **Apple investigations in Tasmania: miscellaneous notes. 8. The influence of carbon dioxide concentration on brown heart and other storage disorders.**—*J. Coun. sci. industr. Res. Aust.*, xi, 1, pp. 47–60, 5 graphs, 1938.

In this progress report on further investigations carried out in Tasmania on the storage disorders of apples [*R.A.M.*, xv, p. 299] the results are given of tests involving continuous storage for 8 weeks in low concentrations of carbon dioxide, pre-storage treatment with high concentrations of carbon dioxide, and carbon dioxide accumulation during the early part of storage. The conclusions tentatively reached may be summarized as follows.

Sturmer, French Crab, and Jonathan apples are, respectively, very susceptible, susceptible, and relatively resistant to brown heart [see above, p. 443]. The danger of injury by high concentrations of carbon dioxide depends on the maturity of the fruit and the period of exposure. A concentration of 3 per cent. carbon dioxide caused brown heart in Sturmer apples picked in May and kept at 32° to 34° F. for 8 weeks, while one of 12 per cent. caused injury in 7 days. Sturmer apples picked in May and kept in unventilated storage at 38° and 44° developed brown heart in 3 and 5 days, respectively. Carbon dioxide production by Sturmer apples increases up to a stage of maturity and then declines. Delay between picking and cooling Sturmer apples hastens ripening, and increases liability to brown heart, whereas cooling before unventilated storage reduces carbon dioxide production and delays the onset of brown heart. When accumulation of carbon dioxide becomes dangerous, rapid ventilation is better than slow. Brown heart develops slowly in apples kept in carbon dioxide, and at least 48 hours' exposure to the air at 50° to 60° is required for the full development of the symptoms after a storage period of two or three weeks.

Sturmer, French Crab, and Jonathan apples show the same relative susceptibility to alcoholic poisoning [ibid., xv, p. 300] as to brown heart, though susceptibility is generally less to the former than to the latter. Susceptibility to alcoholic poisoning increases with carbon dioxide concentration, but declines with increase in temperature. The disorder occurs below 38°.

Pre-storage treatment with high concentrations of carbon dioxide did not reduce low-temperature breakdown, but appeared to increase it in early pickings of Cox's Orange Pippin. Carbon dioxide in the storage air appeared to increase Jonathan spot, while pre-storage treatment with high concentrations of carbon dioxide had the same effect, and increased a similar spotting of Scarlet Pearmain apples. Lenticel scald (a browning of the lenticels in the centre of small, brown, depressed spots) in Sturmer apples was increased by carbon dioxide in the storage air, and by increase of the storage temperature. Late scald [see above, p. 443] (a general, irregular, indefinite browning of the skin of apples stored for prolonged periods at cool and normal air temperatures) occurred on Sturmer Pippin, and appeared to decrease with an increase of temperature, but was unaffected by the presence of carbon dioxide in the storage atmosphere.

Eaves (C. A.). **Physiology of Apples in artificial atmospheres.**—*Sci. Agric.*, xviii, 6, pp. 315–338, 10 figs., 5 graphs, 1938.

A tabulated account is given of experiments in 1935–6 to determine the effect on the physiological activities and disorders of apples (mainly McIntosh, Cox's Orange, and Golden Russet) of storage in atmospheres adjusted to contain varying concentrations of oxygen, carbon dioxide, and nitrogen [see preceding abstract]. From the purely phytopathological standpoint the results showed that at temperatures of 3° to 4·5° C. the invasion (as gauged by the total amount of fruit decay in three months' storage) of the apples by rotting fungi, represented almost entirely in these experiments by *Penicillium expansum*, was considerably

retarded by 10 per cent. carbon dioxide, and to a lesser extent by low (2·5 per cent.) oxygen content. These atmospheres also retarded the growth and sporulation of pure cultures of *P. expansum*. In Cox's Orange apples the onset of functional disorders was induced by increased carbon dioxide concentrations, the breakdown in the 2·5 and 5 per cent. carbon dioxide series being of the 'mealy breakdown' type [ibid., xvii, p. 399]; at the lower concentration the trouble was confined to the peripheral tissues, whereas at the higher it affected rather more the vascular areas. In the apples stored in 10 per cent. carbon dioxide the disintegration of the tissues was more or less limited to the core area, including the 10 main vascular bundles, and was of the 'brown heart' type. The breakdown which occurred in McIntosh and Stark apples stored in 100 per cent. nitrogen was characterized by the development in the cortical region of scattered light brown patches, at first well defined but gradually merging into a band-like area of soft tissue, approximately 0·5 cm. below the epidermis. In advanced stages of development the healthy subepidermal tissue gradually breaks down, followed by external browning of the apple skin and final decay of the entire fruit. Golden Russet apples developed superficial scald when stored for prolonged periods in carbon dioxide.

Fruits affected with physiological disorders were found to be characterized by a high rate of respiration, high rate of moisture loss, low acid content, low total solids, low osmotic pressures, and increased permeability to water and electrolytes.

Holz (W.). **Versuche zur Bekämpfung der Perithezien von Fusicladium dendriticum (Wallr.) Fckl. mittels Kalkstickstoff.** [Experiments on the destruction of the perithecia of *Fusicladium dendriticum* (Wallr.) Fckl by means of calcium cyanamide.]—*Zbl. Bakt.*, Abt. 2, xcvii, 23–26, pp. 466–469, 1938.

Details are given of laboratory experiments at the Stade (Schleswig-Holstein] branch of the Biological Institute in which apple leaves bearing perithecia of *Venturia inaequalis* [*R.A.M.*, xvi, p. 469] were placed in flower pots and treated with unoiled calcium cyanamide at the rates of 10, 20, 50, 100, and 200 gm. per pot on 13th December, 1936. On 2nd April, 1937, perithecial development was found to have been entirely checked in the treated pots, whereas in a control pot containing untreated leaves 80 to 95 per cent. of the perithecia were filled with ascospores. The minimum rate of 10 gm. per pot (surface area, 515 sq. cm.) would correspond to about 20 kg. calcium cyanamide per 100 sq. m., a rate somewhat too high for the avoidance of over manuring with nitrogen, and further tests to determine the efficacy of lower doses must therefore be carried out. Satisfactory results were also obtained by strewing calcium cyanamide over the leaves, which were left to overwinter in the open, and by mixing the leaves with calcium cyanamide and making the whole into a compost heap.

Küthe (K.). **Neuere Ergebnisse der Fusikladium-Forschung.** [Recent results of *Fusicladium* research.]—*Angew. Bot.*, xix, 6, pp. 561–566, 2 diags., 1938.

After concisely summarizing the results of recent studies showing

the diversity of physiologic races comprised not only within apple and pear scab (*Venturia inaequalis* [see preceding abstract] and *V. pirina* [see below, p. 466]), but also within other species of *Venturia* [ibid., xvi, p. 618], the writer briefly describes his investigations in eastern Germany to determine the relation of seasonal conditions to apple scab infection and its control.

In the experimental region the critical period for outbreaks of the disease falls in the last few days of April, following abundant ascospore development, which is also no doubt largely responsible for subsequent attacks during early May. Not until the middle of May do the conidia of *V. inaequalis* begin to play an important part in the dissemination of infection, which persists throughout the late summer. Only preventive sprays (on 18th and 24th April) of Bordeaux mixture were of any avail against a scab outbreak on the 25th and 26th, the later being the more effective of the two; a subsequent application on 2nd May was quite useless, the fungicide being unable to reach the fungus within the foliar tissues.

MANNS (T. F.), ADAMS (J. F.), & HEUBERGER (J. W.). **New spray combinations and new spray materials used on Apples in 1937.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 51–54, 1937.

The authors describe the results [which are tabulated] of several years' tests of new spray combinations made with the object of finding safer and more efficient fungicides for use against apple diseases. Lime-sulphur combined with wettable sulphur was found to control scab [*Venturia inaequalis*: *R.A.M.*, xvi, p. 477; xvii, p. 118] on susceptible varieties such as Paragon and Stayman approximately as effectively as the copper sprays and with very much less russeting. In the control of fruit spot [*Phoma pomi*: ibid., xvi, p. 764], bitter rot [*Glomerella cingulata*: xvii, p. 121], and black rot [*Physalospora obtusa*: xvii, pp. 45, 121] little difference was found between the lime-sulphur and the copper and sulphur combinations. Fruit with a finer finish resulted from combinations with wettable sulphur and also from treatment with lime-sulphur followed after the first cover spray by an application of 2–4–100 Bordeaux mixture. The application of the copper compounds alone or in combination was not safe till after petal fall, or on some varieties until the second cover spray.

WILCOX (J. C.). **Effects of some field plot treatments on drought spot and corky core of the Apple.**—*Sci. Agric.*, xviii, 6, pp. 300–314, 2 figs., 7 graphs, 1938.

Experiments in progress since 1931 at Kelowna, British Columbia, on the effect of various treatments on the development of drought spot and corky core [internal cork] have already shown that these disorders are due to boron deficiency [*R.A.M.*, xvi, p. 686; xvii, p. 119, and above, p. 462]. Where the trees have not been treated with boron, the intensity of the disorders has been influenced by other treatments and details of these results are given in this paper. Insufficient irrigation was found to decrease the vigour of the apple trees, increase drought spot, and markedly increase corky core. Heavy annual applications of sulphate of ammonia induced a more vigorous growth and more severe drought spot; similar applications of superphosphate had little effect on tree

vigour but appeared to increase drought spot slightly. Tree vigour was not apparently affected by heavy applications of muriate of potash, which lessened the severity of drought spot. No measurable effect was exerted on the severity of drought spot by pruning, while tree crowding lessened both the disease and tree vigour. Statistically valid negative correlations were observed between drought spot and percentage bloom, and positive correlations between drought spot and tree vigour. These results would indicate that, under the conditions of the tests, the severity of drought spot was associated not merely with tree vigour as such, but rather more specifically with the supply of nitrogen.

Colhoun (J.). **Fungi causing rots of Apple fruits in storage in Northern Ireland.**—*Ann. appl. Biol.*, xxv, 1, pp. 88–99, 1938.

As a result of investigations in 1934–5 in the more important apple-growing districts of Northern Ireland, over 40 species and strains of fungi were isolated from decaying apples in storage at various orchards, and 16 of these species [which are listed] were experimentally shown to be pathogenic to Bramley's Seedling apples, the main variety grown in the region studied. A large proportion of the rots observed had developed around wounds or the stalk or calyx end of the fruit. Rots radiating from lenticels were comparatively few until the storage was far advanced, and little attention was paid to them. In giving a brief account of pathogenicity tests of the more important pathogens, it is stated that there is evidence that *Phytophthora syringae* [*R.A.M.*, xvi, p. 366] may, under certain circumstances, be of some economic significance in Northern Ireland. Of the two species of *Mucor* isolated, *M. racemosus* was more common than *M. piriformis*, and both rank among the four most important diseases of stored apples in the country. *Penicillium expansum* appeared to be widespread and is the most serious source of damage to apples in storage, another important fungus being *Phoma mali*. *Phomopsis mali* (the pycnidial stage of *Diaporthe perniciosa*) was the dominant species causing rots from Christmas onwards. *Corticium centrifugum* [ibid., xiv, p. 701] was found in only one orchard on a few apples, and the rot caused by it is stated to be essentially a late storage trouble. Other records include *Cytosporella mali* (isolated three times), *Gloeosporium fructigenum* [*Glomerella cingulata*] (once), *Colletotrichum gloeosporioides* (twice), *Fusarium lateritium* var. *fructigenum* [*F. lateritium*] (once) [ibid., xvi, p. 688], and *F. avenaceum* (five times) [ibid., xvi, p. 756].

A brief reference is made to the work of other authors indicating that the main source of storage rots may be traced back to the orchard, and greater care is therefore recommended both in general orchard management and in the handling of the fruit at and after picking; it should not be left lying on the ground in the orchard after collection.

Cheal (W. F.) & Dillon Weston (W. A. R.). **Observations on Pear scab (Venturia pirina Aderh.).**—*Ann. appl. Biol.*, xxv, 1, pp. 206–208, 1 pl., 1938.

Observations at Cambridge in 1936 to determine more precisely the time at which pear trees in the spring are infected with scab (*Venturia pirina*) [*R.A.M.*, xiii, p. 245; xvii, p. 328] showed that on a tree with

infected wood, many of the buds after rain showers were literally bathed in spore suspensions of the fungus, and that when the water evaporated the conidia remained on the bud scales or slightly drawn up amongst the leaves and flowers of developing buds. That infection resulted in this way was confirmed by the fact that the under surfaces of the leaves and the calyces on that tree were the first to become infected. Further observations on Conference pear trees at Tydd Gote, Pitmaston Duchesse at Wilburton, Doyenne du Comice at Wilburton, and an unknown variety at Girton, Cambridge, showed the presence on them of pear scab pustules on the edges of a large number of cankers on four-, five-, six-, seven-, and eight-year-old wood, indicating that in some cases, as yet not definitely explained, the fungus may evade the cork barrier and become perennial. It is suggested that these findings stress the importance of pre-blossom fungicide sprays and the necessity of spraying pear-trees over a much longer period in the season than is required for apples.

JØRSTAD (I.). **Melding om plantesykdommer i land- og hagebruket. Sprøiteforsøk mot soppsykdommer på frukttraer.** [Report on plant diseases in agriculture and horticulture. Spraying experiments against fungous diseases of fruit trees.]—61 pp., Oslo, Grøndahl & Søns Boktrykkeri, 1937. [Received May, 1938.]

Further extensive details are given of official experiments in Norway in the control of apple scab [*Venturia inaequalis*: cf. *R.A.M.*, xi, p. 49] and other fruit diseases from 1931 to 1936. No conclusive evidence of the superiority of Bordeaux mixture over lime-sulphur was forthcoming in the scab trials, the greater toxicity of the former, in the few cases in which it was demonstrated, being more than outweighed by its tendency to scorch the trees. Probably the most effective schedule consists of an early application of Bordeaux mixture (between the unfolding of the buds and blossoming), followed by three treatments with lime-sulphur.

In a four-year experiment against apple canker [*Nectria galligena*] on the Åkerø, Gravenstein, and Signe Tillisch varieties, a combined Bordeaux–lime-sulphur schedule also gave good control, the regular programme being supplemented by an application of 4 per cent. copper sulphate immediately before the unfolding of the buds.

In severe outbreaks of apple mildew [*Podosphaera leucotricha*] on Gravensteins four fungicidal treatments are required, the first to be applied during the unfolding of the overwintered buds. Very satisfactory control was given both by lime-sulphur plus a spreader of 0·5 per cent. wheat flour and by solbardo (Bayer sulphur dust).

As a rule the standard schedule (ordinary or 'white' Bordeaux mixture decreasing from 1 to 0·5 per cent.) gave excellent control of pear scab [*V. pirina*: see preceding abstract], the first treatment being given immediately before the blossom, the second just after, and the third during the green fruit stage.

Empress pears suffering severely from canker [*N. galligena*] recovered to an appreciable extent as a result of regular treatment with Bordeaux mixture from 1929 to 1936, supplemented in 1933–4 by a dormant application of 3 per cent. copper sulphate.

Plum pocket disease [*Taphrina pruni*: ibid., xvi, p. 330] was well controlled on the Rivers' Early Prolific variety by a dormant application of 2 per cent. copper sulphate followed by 1 per cent. Bordeaux mixture just before blossoming, while almost equally good results were obtained with lime-sulphur at the same times (winter strength for the first).

Shot hole of peaches [*Clasterosporium carpophilum*: ibid., xvii, p. 257] was successfully treated with one or two applications of Bordeaux mixture at a strength of 1 per cent. before and 0·5 per cent. after blossoming. A supplementary application, immediately before the unfolding of the buds, of 1 per cent. sodium hydroxide with green soap was effectual against *Monilia* [? *Sclerotinia laxa*].

In a concluding section notes are given on various proprietary substances included in the foregoing trials. Hovdes mildew wash (A/S Torp Bruk, Frederikstad) proved very effective against *P. leucotricha* on apple. Bayer Kupferkalk and Kupferkalk Ob. 21 both gave good control of apple and pear scab but tended to cause scorching, the former on apple only, the latter on both fruits. Bordinette (Cooper, McDougall & Robertson, Ltd., Berkhamsted, Herts., England) and nosprasit (Farbenindustrie, Leverkusen) also proved effective against both apple and pear scab. Bouisol was also effective against the former. Alvesco soluble spreader (Murphy Chemical Co., Ltd., Wheathampstead, Herts., England), spreadite (Murphy), and household gelatine were valuable adjuncts to the various brands of lime-sulphur used in the experiments.

TINDALE (G. B.), TROUT (S. A.) & HUELIN (F. E.). **Investigations on the storage, ripening, and respiration of Pears.**—*J. Dep. Agric. Vict.*, xxxvi, 2, pp. 90–104, 2 figs., 9 graphs, 1938.

In this fully tabulated account of investigations carried out in Victoria into the storage, ripening, and respiration of pears [cf. *R.A.M.*, xiv, p. 373] the authors state that when pears are ripened after a short period in cool storage, the flesh becomes very soft in the over-ripe condition, with a slight grey discoloration, and the skin is usually infected by moulds [unspecified]. The condition is not localized, and suggests general, not core, breakdown. When removed after longer periods of cool storage, pears develop scald or core breakdown [ibid., xiii, pp. 246, 709] in the over-ripe stage. Similar disorders are associated with over-storage, but with this difference, that over-stored pears are devoid of flavour and juice. In over-ripe pears scald and breakdown occur after normal ripening, the pears remaining very soft and juicy. The time at which the disorders of over-ripeness occur depends on the treatment given before ripening. Thus, pears stored at 37° F. for 4, 5, 6, and 7 weeks developed, respectively, 8, 40, 63, and 100 per cent. core breakdown after 7 days at 65°, and others stored at 32° for 6, 8, 10, and 12 weeks developed, respectively, 10, 20, 49, and 86 per cent. core breakdown after 12 days at 65°.

When seven varieties of pears were stored for eight weeks at 34° in atmospheres containing 5, 10, 15, and 25 per cent. carbon dioxide and then ripened at 65°, brown heart injury [ibid., iii, p. 144; cf. above, p. 443] generally appeared when the concentration of carbon dioxide reached 10 per cent., maximum increase in storage life being given by one of 5 per cent. Varieties free from brown heart ripened satisfactorily after

exposure to concentrations of up to 15 per cent., but a fermented taste usually resulted when the carbon dioxide was allowed to accumulate up to 25 per cent.

Significantly more core breakdown occurred in wrapped pears ripened in standard cases in a continuous current of air at 65° than in those ripened in trays under the same conditions, but pears ripened in flat cases showed no significant difference in this respect. In standard cases there was more core breakdown in the inner than in the outer fruits, and retailers are advised to dispose of the inner fruits first.

Pears destined for export should be picked while in a hard, green condition, pre-cooled as soon as possible, and transported overseas at 31° to 32°.

Report of the Low Temperature Research Laboratory, Capetown, 1935–1936.—215 pp., 15 pl., 4 diags., 21 graphs, 1937. [Received April, 1938.]

During the 1935–6 season investigations were continued by R. Davies and W. W. Boyes (pp. 69–129) into the internal breakdown of Japanese varieties of plums (Santa Rosa, Wickson, Gaviota, Kelsey, and several others) grown in the Western Cape Province [*R.A.M.*, xvii, p. 255]. The disorder was restricted to storage temperatures of 31° F. and 45° or occasionally 29° for a storage period of 25 days. The following general conclusions can be drawn from the investigations carried out in this and the preceding two seasons. Storage at 50° allows full ripening in a fairly normal manner. Fruit stored at 45° ripens normally when picked at the more advanced stages of maturity, but showed slight varietal differences in behaviour. Gradual reduction of temperature from 45° to 40° or 37° gives a progressive increase of breakdown, while still further reduction from 37° to 31° shows a progressive decrease, resulting generally in absence of breakdown at 31°, when the storage period is limited to 25 days. Breakdown occurs soonest at the highest temperature at which it occurs, appearing with decreasing rapidity at the following temperatures: 45°, 40°, 37°, 34°, and 31°. The effect of maturity at picking on susceptibility to breakdown is very erratic at all temperatures. The various types of the injury which the authors include under the general term 'internal breakdown' are injection, severe discoloration with radiating cavities, bladderiness, a white ring of dry, spongy tissue, general brownish blush of the flesh, scald, and aeration of the flesh, the two first-named being the most common forms. The gross appearance of the tissues differs considerably with the various combinations of storage and ripening temperatures, maturity, and the length of storage period. Injection of the flesh is encountered in fruit stored for short periods at 31° to 45° and ripened at 65° and could be easily mistaken for the normal over-ripe stage but for the lack of free juice. Severe discoloration with radiating cavities occurs in the fruit which fails to ripen at a post-storage temperature of 45°. It is suggested that for export the plum varieties should be divided into at least two groups, one group being shipped at about 45°, the other either at 31° or about 45°; for the latter group the maturity at picking must be adjusted to the temperature. Accordingly the temperature of ships' chambers should be either raised to 45° or lowered to 31°.

The investigations by R. Davies, H. H. Boyes, and D. T. R. de Villiers (pp. 130–160) on woolliness of peaches developing in cold storage were carried out on the varieties Inkoos, Duke of York, Cape Treestone, Peregrine, Pucelle, and Elberta at storage temperatures of 31°, 34°, 37° and occasionally 29° and 45°, for periods of 10, 17, 24, and 31 days. The breakdown of stored peaches occurring in other countries [ibid., xiv, p. 773] is thought to be identical with the condition known as woolliness in South Africa. Both abnormalities occur much sooner at 37° than at 31° to 32°, and the similarity to internal breakdown of Japanese varieties of plums [see above, p. 469] is very striking. The time required for woolliness to appear depends on the susceptibility and maturity of the fruit. Fruit stored for a short period ripened normally on removal, showing an even creamy texture, much juice, and good aroma and flavour. With the increase of storage period the juice dried out and the flesh became first mushy and slimy, slightly stringy, later spongy with slight general browning, and ultimately coarse with large areas next to the stone severely discoloured and injected. In an advanced stage the fruit when broken by hand resembles a ball of wool; a normal fruit at a certain degree of maturity may, however, look very similar. After 24 days of storage, fruit in the A [early], B [intermediate], and C [late] stages of maturity showed no woolliness at 31°, 100, 47, and 2 per cent., respectively, at 34°, and 100, 45, and 1 per cent., respectively, at 37°. Some evidence is available that woolliness does not occur in Late Crawford peaches stored for 24 days at 45°, is severe at 37°, and absent at 31° even after 31 days of storage. A delay of storage of 48 hours eliminated woolliness in four of six consignments, and a delay of 72 hours was effective in practically all cases. Pre-cooling of the fruit gave almost no advantage. Fruit from a tree affected by 'delayed foliation' and fruit from a normal tree showed, respectively, 100 per cent. and less than 50 per cent. woolliness when stored for 24 hours at 34°.

J. M. Rattray (pp. 167–187) points out that grapes in the greener stages of maturity appeared to be more resistant to wastage, due to *Botrytis* [*cinerea*: ibid., xvii, p. 373], during the season under observation, whereas in the previous season the riper stages showed more resistance. Contrary to last season's results condensation water, which may form when grapes are moved from a cold to a warmer temperature, appeared to promote the germination of *Botrytis* spores and increase infection. Under favourable humidity conditions in cold store *Botrytis* develops freely at 34° F. The time that must elapse before picking grapes after rain has not yet been determined, but outbreaks of *Botrytis* usually occurred in the vineyard within three days after the rain. A wrapper with a low degree of porosity like the 'crystalline' paper used in the experiments is not recommended in seasons of possible *Botrytis* development, as it maintains high humidity conditions in and around the bunch, which, although producing the freshest condition of the grapes, is usually coupled with high wastage. The best results in reducing *Botrytis* wastage were obtained by inserting crêpe paper plugs treated with a 0·5 N solution of iodine into the bunches and using 'crystalline' paper wrappers. Iodized wrappers were more effective when enclosed in 'crystalline' paper. As little handling as possible of

the Raisin Blanc grapes before storage improved their condition after storage. In conformity with last year's results *Botrytis* invariably developed in bunches from which infected berries had been removed. Four per cent. formalin sprayed on to the lining of the boxes had little effect, whereas dusting of bunches with brassisan [ibid., xv, p. 196] prior to packing appeared to be effective when it was applied in large quantities. Irrigated and non-irrigated consignments showed no significant differences in the development of *Botrytis* wastage.

E. Beyers (pp. 187–199) gives further data on 'drop berry' of grapes [ibid., xvi, p. 620] confirming the view that atmospheric conditions and soil moisture before harvesting mainly determined the susceptibility of Waltham Cross grapes to drop at Paarl. Air temperature and humidity during picking and packing may also have some effect. Picking in the morning is preferable to afternoon picking. Direct packing showed little improvement in comparison with 24 hours' delay, but delay of more than 36 hours increased dropping considerably and was detrimental to the quality. Grapes picked at a riper stage than the commercial appeared to be slightly less susceptible to drop. The use of waxed cystalline wrappers resulted in 91 per cent. green stalks and 3·3 per cent. drop as compared with 42 per cent. green stalks and 5·6 per cent. drop for the ordinary sulphite wrapper.

Experiments on the effects of maleic acid on unripe fruit similar to those of Copisarow [ibid., xvi, p. 396] are described by W. E. Isaacs (pp. 199–215). The capacity of maleic acid to retard the ripening of fruit is confirmed, but attention is drawn to the resulting skin injuries. The Pearmain apples treated with amyl acetate alone or with maleic acid and amyl acetate showed more susceptibility to fungal attack in store at 65° and 45° than the controls.

Manns (T. F.) & Heuberger (J. W.). **Some problems in the dissemination of bacterial spot of Peach.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 57–62, 2 figs., 1937.

A very severe outbreak of the bacterial fruit spot of peach (*Bacterium pruni*) [*R.A.M.*, xvii, p. 256], favoured by high humidity and excessive rainfall during the 1937 season, is reported from the Peninsula, Delaware. The varieties J. H. Hale, White Hale, and Elberta were attacked to the extent of 75 to 80 per cent., and three- to four-year-old trees just coming into bearing were those most severely affected; they showed much fruit blotching and spotting and considerable foliar shot hole, but only slight defoliation, which was more severe in six- to eight-year-old trees (possibly due to spray injury). Observations on one-, two-, and three-year-old trees showed that their foliage was much affected by shot hole though very little defoliation had taken place. Fruit from the younger trees showed 75 to 80 per cent. infection as compared with 10 to 25 per cent. in that from older trees. According to the standard spray programme followed in the Peninsula no fungicide is applied to the trees during the first three years of growth, and this accounts for the failure of the routine sprays to control the outbreak of the disease. Culturing on an artificial medium showed that from 10 to 80 per cent. of the buds were carrying infection, although they showed no external signs of it. Examination of the budding stock from several nurseries

proved that they carry much infection. The thermal death point of *Bact. pruni* being 51° C. for 10 minutes, an attempt was made to control the disease with hot-water treatment, which was, however, unsuccessful, because of the injury to the tree, nearly all the buds being killed on exposure to 53° for 15 minutes. Infected nursery stock set in the field in November, 1936, carried the infection through the following summer, whereas the same stock planted and grown in the greenhouse from December, 1936, to November, 1937, was found not to carry any infection in the buds. *Bact. pruni* is known not to thrive in arid regions, and it is therefore advised that August-budded trees be shifted to such regions and taken back later on to be used as budding material.

Vidal (J. L.). **A propos du traitement contre la chlorose calcaire des arbres fruitiers.** [On the treatment of lime-induced chlorosis of fruit trees.]—*C. R. Acad. Agric. Fr.*, cxxiv, 5, pp. 159–164, 1938.

An account (preceded and followed by some pertinent observations by P. Gervais) is given of the writer's completely successful experiments in France on the control of lime-induced chlorosis of the rose [*R.A.M.*, xii, p. 373] and peach [ibid., xv, p. 515]. One of the small roots of a chlorotic rose-bush was immersed on 17th September, 1937, in a flask of 0·75 l. capacity filled with a solution of 20 gm. citric acid. Within a week the condition of the plant improved and by 3rd October it was completely cured. The citric acid had evidently released and rendered soluble the iron in the plant without any supplementary addition of iron to the solution. Chlorosis in peaches was remedied by a similar treatment with the admixture of 100 (or up to 130) mg. iron sulphate in a solution of 20 gm. citric acid and 1,000 gm. water. Signs of recovery began to be noticeable ten days after the commencement of the experiment and the renewal of the normal green coloration proceeded thenceforth with increasing rapidity.

Carneiro (J. G.). **A secca das pontas dos galhos do Pecegueiro.** [Dieback of Peach twigs.]—*Biologico*, iv, 1, pp. 18–19, 1938.

In this note the author records [without further details] the first known discovery of *Phoma persicae* [*R.A.M.*, xv, p. 745] on peaches in Brazil, a very brief account of which is given from the literature. For its control he recommends the careful elimination of all dry wood during the winter pruning of the trees, dormant spraying with 2 per cent. Bordeaux, and weekly or fortnightly spraying with 1 per cent. Bordeaux during vegetation. After pruning all infected material should be immediately burnt.

Thomas (P. H.). **Notes on Apricot 'dieback'. Circumvention by propagative methods.**—*Tasm. J. Agric.*, N.S., ix, 1, pp. 46–49, 3 figs., 1938.

Considerable loss is caused to growers every year throughout the chief apricot areas of Tasmania and in some parts of the mainland of Australia by a die-back [*R.A.M.*, xi, pp. 311, 792] which causes spurs, branches, and entire trees to die off. The cause of the condition has not yet been definitely ascertained, but field observations over a wide area in Tasmania showed that while apricot trees on apricot stock are, as a

rule, completely killed when affected, in apricots worked on cherry plum stocks the disease appears to stop at the graft union, large numbers of strong young plum suckers being produced below. Trials in which selected suckers arising from the roots of diseased trees were worked with apricot grafts and buds at a height of 3 ft. have given highly encouraging results, such rejuvenated trees being unaffected after six years. There would appear to be some evidence that the Moorpark apricot variety is more susceptible to the die-back than other varieties grown in Tasmania.

Zeller (S. M.). **Dwarf disease of the Loganberry.**—*Bett. Fruit*, xxxii, 8, p. 18, 1938.

Though the losses caused by loganberry dwarf disease [cf. *R.A.M.*, vii, p. 183] in the Pacific coast area of the United States are only very slight on the whole, individual growers and certain localities have sustained very heavy losses from the condition. At present, there are two infection areas in Oregon, one situated in western Marion and eastern Polk county, and the other in north-eastern Benton county. In these parts the affected plantings show 2 to 95 per cent. dwarf. Some plantings in the same areas are still unaffected, but the infected plants in the vicinity constitute a source of danger. Roguing is practicable when under 5 per cent. infection is present, and must be thorough, and the affected plants should be burnt immediately.

Ward (F. S.). **Cercospora leaf spot of Bananas.**—*J. Jamaica agric. Soc.*, xlii, 1–2, pp. 23–34, 6 figs., 1938.

In Jamaica, banana leaf spot (*Cercospora musae*) [*R.A.M.*, xvii, p. 375] has only occasionally caused severe damage, and very little injury to the fruit has resulted. The disease has often developed in its worst form in the more recently developed lands, many of which are in some respects not entirely suitable for bananas, and especially in districts which under normal circumstances and even in the absence of the disease produce considerable quantities of inferior fruit. Severe damage has not been sustained in first-class banana lands.

In five months' spraying tests the best control was given by applications at intervals of three weeks of 1 per cent. I.C.I. compound (cuprous oxide) applied at the rate of 250 galls. per acre. Similar applications at fortnightly intervals did not give better control. Applications at intervals of three weeks at concentrations of $\frac{1}{2}$ or 1 per cent., and using 200 to 250 and 150 galls. per acre, respectively, also gave a considerable degree of control. Satisfactory results did not, however, follow applications of $\frac{1}{4}$ per cent. concentration, at the rate of 100 to 250 galls. per acre, at 3-week intervals, or of 1 per cent., at the rate of 250 galls. per acre, at 6-week intervals.

Bordeaux mixture (4–4–40) applied at 3-week intervals (200 to 250 galls. per acre) imparted a better appearance to the foliage than the same treatment at half strength, but the weaker concentration gave better filled fruit; applications at full strength at 6-week intervals (250 galls. per acre) did not give satisfactory control. Preliminary fruit-weighing records indicate definitely that a better grade of fruit is obtained by spraying with the I.C.I. compound than with Bordeaux

mixture. Dusting experiments so far as they have gone indicate that there is no appreciable difference in the degree of control given by I.C.I. and Bordeaux mixture dusts, both being satisfactory when judiciously applied. Bordeaux dust should be applied at the rate of 40 lb. per acre and at least six dustings per annum are recommended.

The variety S.19 (a cross between two varieties of *Musa sapientum*) appears to be virtually immune from the disease, though commercially unsuitable.

[This paper also appears as *Bull.* 15, *Dep. Sci. Agric. Jamaica.*]

DUTTON (W. C.). **The seriousness of spray injury.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 46–50, 1937.

Observations over many years in Delaware have shown that spraying with lime-sulphur is the cause of severe injuries to apple trees [*R.A.M.*, xvii, p. 119] such as leaf-burn, stunting and dwarfing of early leaves, and leaf-fall, mainly of small basal leaves, which impairs the fruit set and the formation of buds in the succeeding season. Arsenicals combined with lime-sulphur also cause serious leaf-fall. In one instance the treatment of 2- to 3-year-old and older trees with lime-sulphur resulted in the formation of 20 and 7 per cent. spurs with fruit, respectively, compared with 46 and 20 per cent. in control trees treated with a non-injurious material. In another instance Jonathan and Hubbardston apple-trees sprayed with lime-sulphur lost 69 per cent. of their leaves as compared with 17 per cent. in the controls. The following spring Jonathan showed 14 per cent. and Hubbardston 22 per cent. spurs with blossoms compared with 51 and 48 per cent. in the controls. In an experiment on Baldwin trees the total of the annual yields per tree from the third to the seventh year, inclusive, of trees treated with lime-sulphur was 1,705 lb. compared with 3,225 lb. in the control. The injuries increased with the increase of the concentration of lime-sulphur and with over-spraying. Injury was greatest in moist, cold, and sunless seasons, the tender and succulent type of leaf then developing being very susceptible to injury.

BUTLER (O. R.). **Lime-sulphur spray injury.**—Reprinted from *J.N.H. hort. Soc.*, ii, 2, pp. 121–128, 1938.

Preliminary studies on the effects of spraying beans [? *Phaseolus vulgaris*] with lime-sulphur solution with and without added acid lead arsenate and calcium arsenate showed that beans respond to lime-sulphur spraying in a similar way to apples. The margin of the young expanding leaves becomes stunted or is killed outright, and the leaves become convex and distorted. Fully expanded leaves remain uninjured. When beans were grown for 79 days at a mean temperature of 66·7° F. and sprayed six times with lime-sulphur (1 in 50) the mean dry weight of the sprayed plants was 71·68 per cent. of that of the unsprayed, the corresponding figure for the fruit alone being 71·46 per cent. Substantial injury was caused by the spraying, but the physiological balance was undisturbed, and the relative development of the fruit and foliage in both series was the same; loss of yield is proportional to foliage injury. When other beans were grown for 91 days at mean temperatures of 66·2° and 56·4° and sprayed eight times with the same

solution the dry weight of the sprayed plants grown at the higher and lower temperatures was, respectively, 83·7 and 72·7 per cent. of that of the unsprayed controls. A test of the loss of weight produced by spraying four to eight times indicated that lime-sulphur spraying does not cause cumulative injury.

When sprayed beans were divided into two lots, one of which was exposed to dew and rain, weathering did not increase the spray injury. When, however, acid lead arsenate or calcium arsenate was added to the spray solution, weathering markedly increased spray injury.

Spray injury was not reduced by diluting the lime-sulphur to 1 in 100 and 1 in 200, but it was found that when cane sugar is added to lime-sulphur solution the sulphides are unaffected, and the solution decomposes more slowly on drying. Osmotic pressure is increased, and penetration of the leaf between application and drying (the period when injury is produced) is impeded. Injury was reduced by between 10 and 30 per cent. when cane sugar was added at the rate of 1 per cent. This beneficial action of sugar was valueless, however, when acid lead arsenate or calcium arsenate was included in the spray.

Erven (H.). **Die Bodendämpfung. Eine neue und wichtige Massnahme für die Landwirtschaft und den Gemüsebau. Die erste Bodendämpfungsgenossenschaft bereits gegründet.** [Soil-steaming. A new and important practice in agriculture and vegetable cultivation. The first co-operative soil-steaming society already founded.]—*Dtsch. landw. Pr.*, lxv, 7, p. 79; 8, p. 94, 4 figs., 1938.

This is a concise survey of the advantages of soil-steaming [*R.A.M.*, xvii, p. 194] over chemical and cultural methods of sterilization against eelworms and other injurious micro-organisms liable to attack agricultural and market-garden crops in Germany. A technical description is given of the Lerch soil-steaming apparatus, consisting of a portable steam boiler with pipes leading to a soil cover inside the greenhouse; details are given of its mode of application, and of the costs involved in the treatment of the soil by this method. The writer has already introduced the co-operative method of soil disinfection into the Rhine Province and foresees its rapid extension throughout the country.

Granovsky (A. A.), Kunkel (L. O.), Leach (J. G.), & Poos (F. W.). **Symposium of the relationship between insects and plant diseases.**—*J. econ. Ent.*, xxxi, 1, pp. 11–39, 1938.

This is a review of contemporary studies on the relationship between insects and diseases of (1) truck crops (A. A. Granovsky, with discussion by D. M. De Long), (2) fruit trees and small fruits (L. O. Kunkel, with discussion by E. M. Searls), (3) shade and forest trees (J. G. Leach), and (4) cereal and forage crops (F. W. Poos, with discussion by J. W. Ingram). Notices of most of the work referred to have appeared from time to time in this *Review*.

Temple (C. E.). **Disease resistance in horticultural crops.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 150–158, 1937.

The author gives a general account of the work carried out and in progress at several experiment stations in the United States,

particularly Maryland, on the breeding of disease-resistant varieties of horticultural crops, including peas, potatoes, cucumbers, spinach, and watermelons.

Roemer (T.), Fuchs (W. H.), & Isenbeck (K.). **Die Züchtung resistenter Rassen der Kulturpflanzen.** [The breeding of resistant races of cultivated plants.]—*Kühn-Arch.*, xlv, 427 pp., 2 col. pl., 35 figs., 4 diags., 2 graphs, 1938.

This volume (the 13th of the *Kühn-Archiv* devoted exclusively to plant breeding) comprises copiously annotated and tabulated sections (each followed by a bibliography of the relevant literature) on the necessity of breeding disease-resistant varieties; the biological foundations of breeding for resistance; the nature of resistance; the inheritance of resistance; the organization of breeding for resistance; together with detailed discussions (constituting the bulk of the volume) of a number of major diseases to be combated by the development of resistant selections, the diseases being treated with particular reference to the biology, mode of infection, and specialization of the causal organisms, varietal reaction of the host, and breeding. Most of the more recent work mentioned has been noticed from time to time in this *Review*.

Drechsler (C.). **Two Hyphomycetes parasitic on oospores of root-rotting Oomycetes.**—*Phytopathology*, xxviii, 2, pp. 81–103, 5 figs., 1938.

One of the two Moniliaceous fungi constantly occurring as vigorous parasites on the oospores and other organs of Pythiaceous root-rotting organisms in culture is identified on the basis of its mostly triradiate and cruciform conidia as *Trinacrium subtile*, while the other, characterized by predominantly triseptate, hyaline, elongate-fusoid, *Fusarium*-like conidia, 35 to 65 by 3·8 to 5·2 μ (mean 50 by 4·5 μ) is described [with Latin and English diagnoses] as *Dactylella spermatophaga* n.sp. Notwithstanding marked differences in conidial design, the two organisms under discussion seem to be closely related taxonomically, both apparently belonging to the predacious series of Hyphomycetes, represented, e.g., by *D. passalopaga* and *D. leptospora* [*R.A.M.*, xvii, p. 36].

Among the *Pythium* spp. attacked by *D. spermatophaga* in the writer's laboratory were *P. arrhenomanes* [ibid., xvii, p. 204], *P. butleri*, *P. de Baryanum*, *P. irregulare*, *P. mamillatum* [ibid., xv, p. 109], and *P. ultimum*. Grown in dual culture with other Oomycetes it further abundantly parasitized the oospores of a number of species, including *P. graminicolum* [ibid., xvii, p. 384], *P. myriotylum* [ibid., xiv, p. 473], *P. oedochilum*, *Phytophthora cactorum*, *P. megasperma* [ibid., xvi, p. 292], and *Aphanomyces euteiches*. Infection is accomplished by the successive perforation of the oogonial and oospore walls, followed by the development within the oospore of a branched, somewhat lobate, rather massive haustorium which assimilates the protoplasmic contents. By reason of its evident capacity for widespread destruction of the oospores on which Oomycetes largely depend for their survival from one season to the next, *D. spermatophaga* may well serve as an effective agent of soil sanitation for protracted periods.

T. subtile occurred as a parasite in cultures of *Pythium butleri* isolated from decayed spinach-crowns.

KOTTE (W.). **Die volkswirtschaftliche Bedeutung der Phytopathologie in Südwestdeutschland.** [The national-economic importance of phytopathology in south-west Germany.]—*Angew. Bot.*, xix, 6, pp. 567–573, 1938.

Some interesting observations are made concerning the phytopathological problems of south-west Germany, the peculiarly varied climatic and geological conditions of which, while facilitating the cultivation of a wide diversity of crops, complicate the establishment of uniform plant protection schedules. Among the chief diseases to be combated may be mentioned winter injury to cereals by *Fusarium*, yellow rust of wheat [*Puccinia glumarum*], potato blight (*Phytophthora*) [*infestans*], hop downy mildew (*Peronospora*) [*Pseudoperonospora humuli*], tobacco wildfire (*Pseudomonas* [*Bacterium*] *tabaci*), and vine downy mildew (*Peronospora*) [*Plasmopara viticola*].

BÄRNER (J.). **'Intrazellulare Stäbe' bei viruskranken Solanaceen und Cucurbitaceen.** ['Intracellular cordons' in virus-diseased Solanaceae and Cucurbitaceae.]—*Angew. Bot.*, xix, 6, pp. 553–561, 7 figs., 1937.

The writer's further studies at the Biological Institute, Dahlem, Berlin, on the significance of 'intracellular cordons' in virus-diseased plants [*R.A.M.*, xvi, p. 704] comprised fresh and fixed transverse sections of potato, tobacco, *Datura stramonium*, *Solanum nigrum*, cucumber, melon, and vegetable marrow. The presence of these bodies was shown not to be necessarily correlated with virus infection, many diseased plants being entirely free from them while, conversely, apparently healthy individuals contained large numbers. No diagnostic importance can, therefore, be attached to the presence or absence of 'intracellular cordons' in the study of virus diseases of the Solanaceae and Cucurbitaceae.

JOSHI (N. V.) & DUTT (S. C.). **Studies on the dissociation of Bacillus cereus, an organism associated with plants affected with mosaic disease.**—*Indian J. agric. Sci.*, vii, 5, pp. 763–783, 3 pl., 1937. [Received May, 1938.]

The authors found that an organism tentatively identified as *Bacillus cereus* was practically always present in mosaic-diseased tomato, *Luffa acutangula*, *Momordica charantia*, *Hibiscus esculentus*, and tobacco-plants [cf. *R.A.M.*, xv, p. 315]. Inoculation experiments with this organism gave inconsistent results and no conclusion can be drawn, therefore, as to whether it is the real cause of mosaic disease. In culture the organism dissociated into several variants, details of which are given in full.

GREENHILL (A. W.). **Boron deficiency in horticultural crops: recent developments.**—*Sci. Hort.*, vi, pp. 191–198, 4 pl. (facing pp. 193, 208, 209, and 224), 1938.

In this paper the author briefly summarizes recent developments in

the use of boron with special reference to vegetables and horticultural crops [*R.A.M.*, xvii, p. 63].

HILITZER (A.). **Pilzerkrankungen und Transpiration.** [Fungous diseases and transpiration.]—*Stud. bot. Čechoslov.*, i, 1, pp. 20–36, 1938.

Enhanced transpiration was a feature of the diseased organs of a number of plants used in the writer's experiments in 1933 at the Prague (Czechoslovakia) Technical College, which involved the accurate measurement, by weighing, of the water-loss in cut leaves. In most cases this phenomenon was found to be primarily due to the rupture of the epidermis (e.g., by the aecidia or uredosori of the rusts), which removed the natural protection afforded by the cuticle. For example, the average loss of water in three *Abies alba* branches infected by *Melampsorella caryophyllacearum* [*R.A.M.*, xvi, p. 350] was 67·4 per cent. of the initial water content, compared with 60·7 per cent. for three healthy branches, while very high figures were also obtained in the case of *Uromyces pisi* on *Euphorbia cyparissias* [ibid., xv, p. 607], and for the following fungi: *Taphrina turgida* and *T. betulae* on birch [ibid., vi, p. 762], *T. pruni* on plum [ibid., xvi, p. 330], *Fusicladium dendriticum* [*Venturia inaequalis*] on apple, and *F.* [*V. pirina*] on pear [ibid., xv, p. 375]. The Peronosporaceae, on the other hand, merely occlude the stomata with their conidiophores without damaging the cuticle and so cause only a slight increase of transpiration. Erysiphaceae gave variable results. The occasional reduction of transpiration in diseased foliage may be due to the protection of the leaf blade by the mycelium, e.g., in the case of *Erysiphe cichoracearum* on *Scorzonera humilis*.

Generally speaking, slight infection has a greater relative effect on the loss of water than heavy infection, while soft, succulent tissues are particularly prone to increased transpiration. Intensive transpiration is a marked characteristic of the early stages of a disease, in the final phase of which, however, the necrotic lesions may give off no water at all.

TAYLOR (C. F.). **The incidence of yellow dwarf in Potato varieties.**—*Amer. Potato J.*, xv, 2, pp. 37–40, 2 diags., 1938.

In 1935 potatoes planted in a varietal test at Ithaca, New York, developed a considerable incidence of yellow dwarf [*R.A.M.*, xvii, pp. 132, 412] ranging from 1·6 per cent. in the variety U.S.D.A. No. 44537 to 48·4 per cent. in Columbia Russet. In 1936 the latter was the only one of nine varieties to show any trace of the disease (2·4 per cent.). The available evidence does not afford a clear explanation of the fluctuation in the extent of yellow dwarf from one year to the next, but the factor involved is probably either inherent varietal predisposition or 'klendusity', i.e., the operation of some varietal character on the rate of occurrence of infection.

FOLSOM (D.), LIBBY (W. C.), SIMPSON (G. W.), & WYMAN (O. L.). **Net necrosis of Potatoes.**—*Bull. Me Coll. Agric. ext. Serv.* 246, 12 pp., 9 figs., 1938.

In this bulletin the authors give brief descriptions [which are well illustrated] of various forms of internal discoloration affecting potato,

including net necrosis (caused by the leaf roll virus) [*R.A.M.*, xvi, pp. 400, 481], freezing injury (sometimes resembling net necrosis but usually accompanied by blotching), heat necrosis, discoloration of fungal origin, such as that due to *Fusarium* or *Verticillium*, and stem-end browning (dark-coloured streaks, ½ to 1 in. long, extending from the stem end, of which the cause is unknown).

MURPHY (P. A.). **Potato virus research and the production of virus-free seed Potatoes.**—*Sci. Hort.*, vi, pp. 215–222, 1938.

In this paper the author states that potato leaf roll [*R.A.M.*, xvii, p. 56] is of negligible importance in Ireland, probably owing to a combination of climatic and cultural conditions. *Myzus persicae* is also very scarce in Ireland, a survey of part of the central plain (N. Tipperary, Offaly, and E. Galway) made on 29th July to 1st August, 1936, showing only 6 out of 15 fields to be infested, and these only to a very limited extent, the numbers present ranging from a trace to 18 per 100 leaves. In northern and eastern Donegal the insect is even rarer.

Potato varieties fall into 4 main groups according to their reaction to the mosaic viruses. Group 1, intolerant of virus X, includes Arran Crest, Epicure, and King Edward VII. These never show simple mosaic (X virus) [ibid., xvi, p. 337 *et passim*], interveinal mosaic (X+F), crinkle (X+A), or rugose mosaic (X+Y); any faint mosaic (as in Arran Crest) is due to Y or A virus. Group 2 (Alannal, Arran Peak, British Queen, Dunbar Standard, Great Scot, International Kidney, Kerr's Pink, Roderick Dhu, Sharpe's Express, Ulster Monarch, and Up-to-Date) is intolerant of virus A and never shows crinkle (X+A); any severe mosaic is likely to be rugose mosaic (Y or X+Y). Group 3 (Arran Banner, Arran Chief, Arran Comrade, Arran Consul, Arran Scout, Arran Signet, Arran Victory, Catriona, Champion, Dunbar Cavalier, Flourball, Golden Wonder, Irish Chieftain, Majestic, and President) is tolerant of viruses X and A and shows crinkle (X+A) and interveinal mosaic (X+F), and some of the varieties may show rugose mosaic (X+Y) also. Varieties tolerant of the Y virus include Arran Consul, Arran Crest, Arran Victory, Champion, Di Vernon, Epicure, International Kidney, and Sharpe's Express. The term 'intolerance' as used above implies reaction by necrotic symptoms under experimental conditions and freedom of the variety in the field from the particular virus concerned [cf. ibid., xvii, pp. 338, 341].

A survey is given of the progress made in producing virus-free seed stocks. The new virus-free Champion variety is promising well and it is hoped that it will prove the beginning of a new class of really healthy seed.

Of other viruses present Up-to-Date streak (virus B) and paracrinkle in King Edward (virus E) are universal in these carrier varieties but are never seen on intolerant sorts. Viruses C and D are without practical importance, F and G are rare and their effect is slight apart from producing brown flecks in the tubers, probably included under the term 'spraing'.

LOUGHNANE (J. B.) & MURPHY (P. A.). **Mode of dissemination of Potato virus X.**—*Nature, Lond.*, cxli, 3559, p. 120, 1938.

In an experiment at the Albert Agricultural College, Glasnevin,

Dublin, to determine the mode of dissemination of potato virus X [see preceding abstract], four lots of cut pieces of healthy tubers were interplanted with infected tubers under varying conditions. The first lot of 27 pieces (A) was grown in pots on one side of a small insect-proof glasshouse compartment with the haulms of the healthy and diseased plants in contact, 14 of the healthy plants being in the same pot as a diseased plant, and 13 in separate pots. Contact was assisted by the play of an oscillating electric fan from a distance of 3ft. for about nine hours a week. The second lot (B) was grown on the opposite side of the house under identical conditions except for (*a*) the separation of diseased from healthy plants by cylinders of $\frac{1}{2}$ in. wire netting round the former, and (*b*) the absence of the fan. The third lot (C) of 14 pieces was planted in three drills in the field with the diseased and healthy plants alternating at a distance of 1 ft., three of the healthy tubers and the adjacent diseased ones being planted in 9 in. pots sunk in the ground to minimize root contact. The fourth lot (D) was grown 4 ft. away under the same conditions except that the haulms of the diseased plants were enclosed in two cylinders of $\frac{1}{2}$ in. wire mesh cylinders one inside the other with about 1 in. between.

The presence of virus X was determined by inoculation into *Datura stramonium* at intervals. All the plants from sound tubers proved to be free from virus X at first, but infection afterwards developed in each lot as follows: (A) 8 out of 27, (B) none, (C) 2 out of 14, (D) none. Of the 8 infected plants of (A), 3 were in separate pots and 5 in the same pot as a diseased plant. No evidence of infection through root contact was forthcoming either in (A) or (B).

In a further test in the greenhouse on the same general lines to assess the effect of the fan on plants from X-free tubers in separate pots, 4 out of 16 with haulms in contact became diseased under the influence of the fan, 1 out of 16 in contact without the fan, and none with the haulms separated. It appears from these data that virus X is readily disseminated within a potato crop by leaf contact, probably mainly under the influence of wind. It is unlikely that insects are implicated in the transmission of the disease, and the risk of underground infection is negligible.

Brentzel (W. E.). **'Purple top' wilt of Potato in North Dakota.**—*Plant Dis. Reptr*, xxii, 2, pp. 44–45, 1938. [Mimeographed.]

A potato wilt disease, referred to locally as 'purple top', has been troublesome in North Dakota since June 1937. In the middle of the month about 1 per cent. of the plants in a few fields showed traces of purple top, with no root symptoms; on 20th August, 3 to 5 per cent. of the plants were definitely diseased, showing small, crinkly leaflets purple about the veins. On 1st September, after warm weather, 20 per cent. of the plants had developed severe crinkling of the leaflets with purple veins, the discoloration extending down the main stems to ground-level. Aerial tubers were formed, the leaves wilted, and the plants drooped. No dwarfing was observed. The stolons were often 'beaded' and there was an abundant formation of fibrous roots. Often some of the root tips emerged from the ground and formed green shoots. Late potatoes gave a reduced yield, and many of the tubers were small.

Many tubers showed stem-end discolorations, and the stems were discoloured in the vascular region, particularly near the seed-piece, which was invariably rotted, and apparently constituted the focus of infection. The tubers were often soft or shrivelled, dull red, and very smooth, with shallow eyes. All the varieties examined (Triumph, Cobbler, and Ohio) were affected, and the disease occurred on all soil types. Many tubers from affected plants developed weak, spindly sprouts.

SANFORD (G. B.). **Studies on Rhizoctonia solani Kühn. III. Racial differences in pathogenicity.**—*Canad. J. Res.*, Sect. C, xvi, 2, pp. 53–64, 1 pl., 1938.

In continuation of these studies [*R.A.M.*, xvi, pp. 338, 769] the author gives details of experiments at Edmonton, Alberta, in which he tested the pathogenicity to young stems of the Early Ohio potato of 133 isolates of *Rhizoctonia* [*Corticium*] *solani*, 114 of which were obtained from random sclerotia collected on random potato tubers from four different fields, 13 from lesions on potato stems, and 8 from single basidiospores. Of this total only 18 per cent. proved to be highly virulent on young potato stems grown in a fertile virgin black loam, and 34 per cent. on stems grown in infertile white podsol soil, both at optimum moisture conditions, the percentages of non-pathogenic or very weakly pathogenic isolates being 72 and 48 for the two soils, respectively. Generally speaking these tests indicate that, under average soil conditions, approximately 20 to 50 per cent. of the isolates of the fungus from sclerotia on random tubers may be assigned to the zero or marginal classes of pathogenic rank; there was an indication that sclerotia from one field may be more dangerous than those from another, and some evidence was obtained that a fairly large proportion of the virulent isolates may arise from the *Corticium* stage, which may be prevalent in a field where the potato plants are markedly free from disease lesions.

It is believed that in having demonstrated the effect of soil type and racial differences in pathogenicity of *C. solani*, the results of this study may help to explain why the stems of a high percentage of plants from sclerotia-bearing setts often escape with little or no infection under field conditions.

EHRKE [G.]. **Kartoffel-Beizung. Ihre Bedeutung für Deutschland und die Möglichkeiten der praktischen Durchführung.** [Potato disinfection. Its importance for Germany and the possibilities of practical application.]—*Dtsch. landw. Pr.*, lxv, 7, pp. 75–76; 8, p. 92, 1938.

The writer discusses the advantages and drawbacks of seed-potato treatment against scab (*Actinomyces*) [*scabies*] and *Rhizoctonia* [*Corticium*] *solani* from the German grower's standpoint. An increased yield of 300 to 400 kg. per hect. would be necessary to cover the expenses of disinfection [cf. *R.A.M.*, iii, p. 603], and the unfavourable situation of Germany, both as regards climate and methods of agricultural organization, as compared with Holland, England, and Northern Ireland (where seed treatment with aretan [ibid., xvii, p. 293

and next abstract] is stated to be steadily gaining ground) must also be taken into consideration; the problem, however, demands thorough investigation. The various methods of seed-tuber and soil disinfection in current use in the United States against the two diseases under discussion are fully described [ibid., xvii, p. 92].

Erven (H.). **Aus der Praxis der Kartoffelbeizung zur Bekämpfung der Pockenkrankheit.** [Practical notes on Potato disinfection for black scurf control.]—*Dtsch. landw. Pr.*, lxv, 9, pp. 103–104, 6 figs., 1938.

Attention is drawn to the steadily increasing prevalence in Germany of recent years of the *Rhizoctonia* disease of potatoes [*Corticium solani*] and to the need for its control by seed treatment [see preceding abstract]. In this connexion the symptoms of the disorder are described and cultural measures for its prevention indicated. Hitherto the seed tubers have been treated with formaldehyde or corrosive sublimate, but since 1933 immersion for 20 to 30 minutes in 0·15 per cent. aretan has been officially recognized in Holland as the most practical means of combating the fungus, and the writer's recent experiments with this preparation in Germany have also given very satisfactory results. The cost of the treatment is estimated at Rm. 1.60 per 50 kg. of seed tubers. The temperature of the liquid should be maintained between 7° and 13° C., preferably round about 10°.

Aamisepp (J.). **Kartul läinud aasta kasvutingimustes, peamiselt Jôgeva katse-ja uurimistulemuste andmeil.** [The Potato under the vegetation conditions of the year 1937, with special reference to the outcome of researches at the Jôgeva Experiment Station.]—*Agronoomia*, xviii, 2, pp. 59–63, 1938. [Estonian, with German summary on p. 119.]

At the Jôgeva Experiment and Plant Breeding Station, Estonia, a high degree of resistance to potato blight (*Phytophthora infestans*) was shown by Böhm's Bodenkraft and two seedlings developed at the Station, 2170 and 1574. Wilt (*Verticillium albo-atrum*) was observed at Jôgeva for the first time during the period under review, attacking some of the yellow-fleshed varieties. Resistance to scab (*Actinomyces scabies*) was shown by the Station seedlings 2228–32. Good control of *Rhizoctonia* [*Corticium*] *solani*, which extensively affected early varieties, was obtained by tuber disinfection with aretan [see preceding abstracts].

Reddick (D.) & Mills (W.). **Building up virulence in Phytophthora infestans.**—*Amer. Potato J.*, xv, 2, pp. 29–34, 1938.

The virulence of a culture of *Phytophthora infestans* [*R.A.M.*, xvii, p. 267] was increased in experiments at Ithaca, New York, by passage though resistant potato varieties, viz., Evergreen (somewhat resistant), President (considerably resistant), and KB/5 (usually immune) in succession, to a point at which a number of hybrids giving an immune reaction in comparison with standard varieties, such as Green Mountain or Russet Rural, were severely blighted. A similar progressive increase of virulence occurred in September 1937 in a two-acre field containing 272 different lots of hybrids. The original source of infection was a small lot of potatoes separated by a wide hedge from KB/5. Blight

spread on 3rd September to a plant of 210/13, known to be susceptible, about 150 ft. from the hedge, and became abundant on this variety. Three days later 40 or 50 lots of plants, inoculated and found immune in greenhouse tests, were blighted whilst KB/5 remained uninfected. Finally on 22nd September large lesions were found on KB/5. A gap still exists, however, that has not been bridged either naturally or artificially between KB/5 and immune hybrids, such as ET/9, many of which remain free from infection by cultures of any degree of virulence.

Some speculative observations are made concerning the apparent loss of resistance to late blight in the Champion variety and the occurrence of physiologic specialization in *P. infestans*, with special reference to Berg's view, rejected by the writers, that two races of the fungus exist in North America, one primarily attacking potatoes and the other preferring the tomato as a host [ibid., vi, p. 583; cf. xv, p. 405].

Roth (H.). **Ein Gang durch deutsche Hochzuchtstätten. Arbeiten und Ergebnisse der Saatkartoffel-Hochzucht C. Raddatz, Hufenberg und Wisbuhr b. Köslin (Pomm.).** [A tour through German plant-breeding stations. Work and results at the Seed-potato-breeding stations of C. Raddatz at Hufenberg and Wisbuhr, near Köslin (Pomerania).]—*Dtsch. landw. Pr.*, lxv, 5, pp. 51–52; 6, pp. 65–66, 5 figs., 1938.

Details are given of various aspects of the work of breeding disease-resistant and otherwise commercially acceptable potato varieties for seed at two stations in Pomerania, Germany. Four such varieties are Voran, Ostbote, Altgold, and Frühgold, all of which are immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, xvii, p. 198]; Voran and Ostbote are further resistant to 'Eisenfleckigkeit' [ibid., xvii, p. 410] and moderately so to scab [*Actinomyces scabies*: ibid., xvii, p. 413], while the former is subject only to occasional mild infection by *Phytophthora* [*infestans*: see preceding abstract], the last-named fungus being also virtually innocuous to Altgold. Frühgold is resistant to leaf roll and mosaic. Certain selections have further been developed which exhibit a high degree of resistance to the widespread A form of *P. infestans* [ibid., xvi, p. 403].

Schlumberger [O.]. **Kartoffelsortenprüfung auf Schorfwiderstandsfähigkeit.** [Potato variety testing for scab resistance.]—*Mitt. Landw., Berl.*, liii, 5, p. 99, 1938.

The annual German official potato trials for resistance to scab [*Actinomyces scabies*: see preceding abstract] on different soil types in the Mark Brandenburg [*R.A.M.*, xvi, p. 403] in 1937 involved 31 varieties, of which 24 were tested for the first, 5 for the second, and 2 for the third time. Only one of the varieties newly submitted for trial satisfied the requirements for commercial resistance (a minimum of 60 per cent. marketable tubers), namely, von Kameke 469/02. Similarly, von Kameke 477/31 and Volltreffer were the only representatives of the second- and third-year groups, respectively, to reach the necessary standard. Speisegelb, tested for the fourth successive year, was found to be only moderately resistant. The disappointing outcome of these

experiments emphasizes the necessity of exploring other methods of scab control, notably seed treatment.

MANNS (T. F.) & HEUBERGER (J. W.). **Sweet Potato sprout treatments for the control of wilt disease.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 127–130, 1937.

Two years' tests of copper and mercury compounds for the control of sweet potato wilt or stem-rot [*Fusarium bulbigenum* var. *batatas* and *F. oxysporum* f. 2: *R.A.M.*, xvi, pp. 369, 440] carried out at the Delaware and Maryland Experiment Stations on the sprouts of the susceptible variety Cederville showed that dipping the roots in various disinfectants was more successful than adding the materials to the tank on the transplanter. In practically all cases the setting of sprouts with McCall's nutrient solution stimulated the early growth of the plant; although better control of wilt resulted from setting with water in conjunction with the fungicidal treatments. Several of the fungicides used reduced the disease to an average of 4 to 5 per cent. in 1936 and 3 to 7 per cent. in 1937, whereas the untreated sprouts averaged 64 per cent. and 31 per cent. wilt, respectively, in the two years. Of the insoluble copper compounds tried basic copper sulphate at a rate of $2\frac{1}{2}$ lb. in 50 gals. gave the highest yield of primes and the highest total yield; copper zeolite (5–50) and cuprocide ($1\frac{1}{2}$–50) also controlled the disease satisfactorily, giving as good results as new improved semesan bel or mercuric chloride. The insoluble copper compounds have the advantage of being cheaper than the mercury preparations, are less toxic to the plant tissue, and cause less retardation to the growth of the plants.

HANSON (E. W.). **Parasitism and physiologic specialization in Fomes lignosus.**—Abs. in *Phytopathology*, xxviii, 1, p. 8, 1938.

Hevea rubber and *Ficus elastica* in soil artificially inoculated with a Liberian culture of *Fomes lignosus* [*R.A.M.*, xvii, p. 202] in Minnesota developed typical white root symptoms five weeks after infection and were dead in six weeks. The fungus was present in profusion in the dead root tissues, from which it was re-isolated and found to agree in all respects with the original cultures. *F. lignosus* was further shown by inoculation experiments to be pathogenic to Navy beans [*Phaseolus vulgaris*], soy-beans, cowpeas, and garden peas. Comparative studies on the Liberian strain of the fungus and a Malayan culture revealed important differences, the latter, for instance, producing a finer and more rapidly growing mycelium than the former. The optimum temperatures of the Liberian and Malayan strains are 27° and 32° C., respectively, and the latter requires considerably more moisture for optimum growth than the former.

DEYL (M.). **Ueber die Mikrobiologie der alpinen Böden in den Ostkarpathen.** [On the microbiology of the alpine soils in the eastern Carpathians.]—*Stud. bot. Čechoslov.*, i, 1, pp. 10–19, 1 graph, 1938.

A tabulated account is given of the writer's studies on the microflora of various soil types in Czechoslovakia, from the results of which it appears that [unspecified] fungi predominate over bacteria in the upper horizons of the more acid soils. They are probably largely responsible

in silicate soils for the initial processes of the disintegration of plant refuse. As regards the particular ecological associations investigated, the numbers of fungi per gm. of damp soil underlying *Vaccinium myrtillus* at depths of 5, 12, 20, and 50 cm. were 800,000, 100,000, 70,000, and 60,000, respectively; under *Juncus trifidus* at 5, 15, and 30 cm. 500,000, 200,000, and 130,000, respectively; under *Vaccinium uliginosum* and *Carex sempervivens-V. myrtillus* at 5 and 25 cm. 600,000 and 200,000, respectively; under *Adenostylum alliaria* at 5 and 45 cm. 400,000 and 200,000 respectively; under *Calamagrostis villosa* at 5 and 45 cm. 300,000 and 120,000, respectively; and under *Deschampsia caespitosa* at 5 and 70 cm. 300,000 and 50,000, respectively. Moulds were the principal agents of cellulose decomposition, a process which was, however, very slowly and ineffectually accomplished by these organisms.

D'Oliveira (B.). **New hosts for the aecidial stage of Uromyces graminis (Niessl) Diet.**—*Bol. Soc. broteriana*, Sér. II, xiii, pp. 81–89, 2 pl., 1938.

A genetic connexion was established by means of cross-inoculation experiments between *Uromyces graminis* on *Melica ciliata* and *Aecidium foeniculi*, the latter observed in profusion on fennel (*Foeniculum vulgare*) leaves, stems, and buds near Lisbon in 1935. Among the 15 species of Umbelliferae successfully inoculated with the sporidia of *U. graminis* were carrot, coriander (*Coriandrum sativum*), and two horticultural varieties of parsley. The aecidial stage of the rust appears to be restricted to fennel in Portugal.

Schindler (H.). **Der Pfefferminzrost.** [Peppermint rust.]—*Kranke Pflanze*, xv, 2, pp. 28–30, 1938.

A semi-popular account is given of peppermint (*Mentha piperita*) rust (*Puccinia menthae*) [*R.A.M.*, xvii, p. 6], which is stated to be responsible for heavy damage to the German crop. Attention is drawn to the importance of climate in the cultivation of peppermint and the choice of protected situations in localities with a relatively mild winter is recommended, as well as an annual change of site of the beds.

Baines (R. C.). **Mint anthracnose.**—*Phytopathology*, xxviii, 2, pp. 103–113, 3 figs., 1 graph, 1938.

Black peppermint (*Mentha piperita* var. *vulgaris*) and spearmint (*M. spicata*) in Indiana are subject to anthracnose (*Sphaceloma menthae*) [*R.A.M.*, xvii, p. 203], severe infection by which results in defoliation and young stem and stolon blight, causing appreciable losses. The disease was induced by artificial inoculation on white (*M. piperita*), black, and State peppermints, common and Scotch spearmint, and Japanese mint (*M. arvensis* var. *piperascens*). The mycelium is largely intercellular and sparsely distributed in the necrotic tissue. The unicellular conidia are sessile on a superficial stroma. The fungus grows slowly on malt extract, potato dextrose, and Leonian's agar media, producing a brown, heaped type of colony. Good growth was obtained at a temperature range of 14° to 28° C. on media adjusted to P_H values between 3·6 and 8·2. Infection and the development of the disease were favoured by temperatures ranging from 21° to 26·8°. *S. menthae*

overwinters on infected mint refuse and is introduced into new fields on diseased plants.

UPPAL (B. N.), PATEL (M. K.), & KAMAT (M. N.). **Alternaria blight of Cumin.**—*Indian J. agric. Sci.*, viii, 1, pp. 49–62, 3 pl., 1938.

English and Latin diagnoses are given of *Alternaria burnsii* n.sp., the agent of a sporadic blight of the living branches, leaves, and fruit of cumin (*Cuminum cyminum*) occurring along water channels and shady places in the Kaira district of Gujarat, India [*R.A.M.*, xiv, p. 560]. Affected plants show minute, whitish, necrotic areas which turn purple, later brown, and finally black, the disease ultimately causing the death of the whole plants or only of the affected parts. On potato dextrose agar the pale olive-green hyphae are 1·7 to 5·8 μ in diameter; the solitary or fasciculate, erect, simple or branched, straight or bent, geniculate conidiophores, sometimes with a single terminal scar, are 3- to 5-celled (rarely 8-celled on the host), and measure 15 to 52 by 1·9 to 3·7 μ; the obovate, occasionally obclavate, olive-brown conidia, borne singly on the host but in chains of 2 to 10 in culture, are furnished with 1 to 9, mostly 3 to 5 transverse septa, taper towards the apex, which may be elongated into a beak often as long as the spore, and measure 13·8 to 55·1 by 6·9 to 25·2 μ without the beak and 23 to 118·9 by 7 to 29·9 μ with it.

The minimum, optimum, and maximum temperatures for the development of *A. burnsii* were found to be 4·5°, 26° to 30°, and 35° C., respectively. Under local conditions the optimum generally prevails during the growing period of the host (November to February), and humid conditions at the same time contribute to destructive attacks of the blight. The scanty amount of seed produced by affected plants is shrivelled, discoloured, and of poor germinability. Maltose, dextrose, and levulose constituted the best sources of carbon. A modified Richards's agar (omitting potassium nitrate) and the same plus sodium asparaginate proved to be most favourable for the nitrogen metabolism of the fungus. Of the liquid media tested, Meyer's was the most suitable, followed by Richards's and Czapek's. The optimum hydrogen-ion concentration for growth appears to lie between P_H 6 and 7. The fungus is highly pathogenic to its own host (in the presence of moisture only), but cross-inoculation experiments on eight other plants gave negative results. *A. burnsii* was shown to be capable of oversummering on plant debris in the field, while infected seed is probably also instrumental in the perpetuation of the fungus and the initiation of primary infection.

Outbreak of Fiji disease.—*Aust. Sug. J.*, xxix, 11, pp. 688–689, 1938.

About 17 farms in the Qunaba and Tantitha districts, near Bundaberg, Queensland, are stated to be affected by the recent outbreaks of Fiji disease of sugar-cane [*R.A.M.*, xvii, p. 345], which, according to N. J. King, Officer in charge of the Bundaberg Experiment Station, constitutes a serious threat to P.O.J. 2878, extensively cultivated in the area on account of its resistance to gumming disease [*Bacterium vasculorum*]. Varieties resistant to Fiji disease include P.O.J. 213 and 234, Co. 290, Oramboo, Korpi, and Q 813. Growers are urged to co-operate

with the Experiment Station authorities in the adoption of energetic measures for the elimination of the disease.

Martin (J. P.). **Pathology.**—*Rep. Hawaii Sug. Exp. Sta., 1937* (ex *Proc. Hawaii Sug. Pl. Ass. 1937*), pp. 28–34, 1938.

In this report [cf. *R.A.M.*, xvi, p. 561] it is stated that leaf burn observed in localized areas of a field of 28–2055 sugar-cane was shown by borings to be due to variation in soil depth. Where the condition was severe the soil ranged from 15 to 20 in. in depth, whereas in the healthy areas it was over 3 ft. deep.

Eye spot [*Helminthosporium ocellum*: ibid., xvi, p. 516] was a serious problem on several plantations, the commercial variety most severely affected being H 109. The rapid spread of the fungus was favoured by frequent rains, and epidemics may therefore be expected from time to time where a susceptible variety is grown. Initial outbreaks usually occur year after year in the same locality, and as environmental conditions are so favourable to infection in these districts every effort should be made to replace susceptible by resistant varieties. In the section of this report dealing with genetics (by A. J. Mangelsdorf and C. G. Lennox) it is stated (pp. 40–41) that, contrary to the opinion previously held, a cane susceptible to eye spot is everywhere a potential danger, and is of little interest from a commercial point of view.

Varieties making subnormal growth owing to drought or soil infertility are almost invariably more susceptible to leaf scald (*Bacterium albilineans*) [ibid., xvii, p. 66] than varieties growing normally. Owing to the recently more favourable conditions for growth the disease has caused only small losses even in areas where it was previously serious.

Observations during a varietal resistance trial laid down in May and June, 1935, and harvested in April, 1937, in which cuttings of 170 sugar-cane varieties were inoculated with *Bact. albilineans* before planting, demonstrated that leaf scald symptoms appeared only on the highly susceptible varieties 29–3859 and Waipahu 153, which had a low degree of tolerance even when conditions were unfavourable to infection; it can be assumed that most commercial varieties now grown locally are highly resistant. In September, 1937, all the varieties under test were cut back, and a heavy suspension of *Bact. albilineans* was brushed over the cut surfaces of the stubble. The results indicated that the disease is much more easily transmitted in this way than by inoculating the cuttings before planting. In another experiment healthy Waipahu 153 cane was grown in three cages until millable cane was available, and rats fed on Yellow Caledonia cane affected by leaf scald were then allowed to feed on the stalks in two of the cages, with the result that the stalks chewed by the rats became infected. It is therefore concluded that under field conditions rats can transmit the disease.

Rands (R. D.) & Dopp (E.). **Influence of certain harmful soil constituents on severity of Pythium root rot of Sugar-Cane.**—*J. agric. Res.*, lvi, 1, pp. 53–67, 3 figs., 2 graphs, 1938.

A detailed account is given of greenhouse experiments on the effect of hydrogen sulphide and salicylic aldehyde on the susceptibility of

sugar-cane plants grown in sand-nutrient cultures to root rot caused by *Pythium arrhenomanes* [see above, p. 476], both compounds being selected as examples of the deleterious substances that may arise during temporary waterlogging in poorly drained, heavy clay soils of the Louisiana sugar district. The results showed that hydrogen sulphide by itself, at concentrations of 10 and 50 p.p. million, reduced the growth of the sugar-cane tops by approximately 21 and 26 per cent., respectively. *P. arrhenomanes* alone reduced it by 31 per cent., and both in combination by 30 and 36 per cent., indicating the absence of any special influence of the sulphide on the intensity of disease. Salicylic aldehyde alone, on the other hand, at concentrations of 20 to 40 p.p.m. had little if any effect on cane growth and no effect on the fungus in culture, but in combination with the latter it reduced the weight of the plants from two to seven times as much as *P. arrhenomanes* alone. It is considered, therefore, that the presence of this or similarly behaving compounds in the soil would account at least in part for the frequently severe root rot observed in all but the most resistant sugar-cane varieties, a conception supported by the marked increase in yield which has in numerous instances resulted even in resistant varieties from improved drainage and amelioration of soil fertility.

TATE (H. D.). & WADLEY (F. M.). **Studies on Sugar Cane insects in Puerto Rico.**—*Agric. Notes, Mayaguez Exp. Sta., P.R.*, 83, 1938. [Abs. in *Facts ab. Sug.*, xxxiii, 4, p. 38, 1938.]

Sugar-cane mosaic is stated to be transmissible in Porto Rico by three insects, viz., *Aphis maidis*, occurring all over the island but mostly in small numbers, except on maize; *Hysteroneura setariae* [*R.A.M.*, xv, p. 743], commonly found on grasses and in the southern coastal region also on sugar-cane (as in Louisiana) [ibid., xvii, p. 67]; and *Carolinaia cyperi*, widely distributed on the ubiquitous 'coqui' [*Cyperus rotundus*]. *A. maidis* is most abundant in the rainy season and the other two during dry weather. The spread of mosaic is more rapid on cane near other kinds of plants than in solidly planted blocks of cane covering large areas.

WEST (J.). **A preliminary list of plant diseases in Nigeria.**—*Kew Bull., 1938*, 1, pp. 17–23, 1938.

Included in this list (arranged in alphabetical order of the hosts) of over 130 fungal, bacterial, virus, physiological, and undetermined diseases affecting 55 hosts in Nigeria are all the available records of previous workers on mycology in the Colony, in addition to the author's own collections.

BOYLE (L. W.) & MCKINNEY (H. H.). **Local virus infections in relation to leaf epidermal cells.**—*Phytopathology*, xxviii, 2, pp. 114–122, 1938.

This is an expanded account of the writers' studies on the relative importance of trichomes and other leaf epidermal cells as points of entry for the tobacco mosaic virus, a note on which has already been published [*R.A.M.*, xvi, p. 766].

SPENCER (E. L.). **Seasonal variations in susceptibility of Tobacco to infection with Tobacco-mosaic virus.**—*Phytopathology*, xxviii, 2, pp. 147–150, 2 graphs, 1938.

In this study at the Rockefeller Institute for Medical Research, Princeton, New Jersey, once each week for 129 consecutive weeks (from 1935 to 1937) 126 seedlings of Turkish tobacco were transplanted into pots and three days later inoculated with tobacco mosaic (Johnson's tobacco virus 1). The results showed definite variations in the susceptibility of plants to infection by the virus. Susceptibility was found to reach a maximum during the early summer (June and July), when high temperatures (approximately 80° to 83° F.) prevailed, accompanied by protracted sunshine (about 11 hours daily), and to decline during the late winter and early spring. The incubation period of the virus within the plant showed a direct correlation with seasonal fluctuations in light and temperature, lasting only four to five days in June and July compared with six or seven in December and January.

THORNBERRY (H. H.), VALLEAU (W. D.), & JOHNSON (E. M.). **Inactivation of Tobacco-mosaic virus in cured Tobacco leaves by dry heat.**—*Phytopathology*, xxviii, 2, pp. 129–134, 1 graph, 1938.

A tabulated account is given of the writers' tests at the Kentucky Agricultural Experiment Station in the inactivation by dry heat of the mosaic virus in two lots of White Burley Tobacco, one cured in 1882 and still retaining some mosaic virulence, and the other in 1936, infected by the yellow, green, and burning strains of tobacco mosaic. Part of the latter material, after seven days' drying at room temperature over concentrated sulphuric acid, was powdered, placed in cotton-plugged glass vials, and exposed to heat in an electric oven, while the rest was twisted and allowed to dry in the laboratory before heating. The infectivity of the samples was measured by the local-lesion method on primary Scotia bean [*Phaseolus vulgaris*] leaves.

The three strains of the virus exhibited a similar degree of tolerance in respect of dry heat, all the samples remaining infectious after the maximum exposure of 60 hours at 70° C., while at 80°, 90°, 100°, 110°, 120°, 130°, 140°, and 150° the times for complete inactivation were 50, 20, 10, 5, 1, 0·5 to 0·4, 0·4, and 0·4 hours, respectively. Virus in green tobacco (92 per cent. moisture) remained infectious after 70 hours' exposure to temperatures of 70° and 80°, whereas at 90°, 100°, and 110° it was totally inactivated in 2, 2, and 1 hours, respectively. Virus inactivation in tobacco samples cured in 1882 was similar to that in samples recently cured.

THUNG (T. H.). **Phytopathologische waarnemingen.** [Phytopathological observations.]—*ex* Jaarverslag Oogstjaar 1936–1937.—*Meded. Proefst. vorstenl. Tab.*, 85, pp. 25–39, 1938.

Further substantial progress was made during the period under review in the control of tobacco mosaic in the Vorstenland (Java) tobacco plantations [*R.A.M.*, xvi, p. 779] by the use of formalin for disinfecting the workers' hands prior to planting operations. Under local conditions there is little likelihood of the persistence of the virus

in the soil after the roguing out of diseased plants, but in order to guard against this eventuality it may be well to replace the infected material by plants affected by mild mosaic, which exerts a protective action against the severe form [ibid., xvi, p. 414], and was shown in experiments with the hybrid variety Chlorina × KW 10 to cause much smaller reductions in yield.

As pointed out in the previous year's report, slime disease [*Bacterium solanacearum*] is locally increasing in prevalence, whereas the incidence of *Phytophthora* [*parasitica nicotianae*] appears to be declining, partly owing to the cultivation in the critical areas of the resistant Timor variety. Two Deli [Sumatra] selections, A and B, compared favourably with Y 10, an American selection, and an Ambalema cross in resistance to *Bact. solanacearum* in a test on one estate.

The virtual freedom of the Vorstenland from mildew [*Erysiphe cichoracearum*] during the 1936–7 season is attributed to the timely application of sulphur and the cultivation of the resistant Timor variety. A further increase in the prevalence of the highly infectious stem-rot (*Bacillus* [*Erwinia*] *aroideae*) was registered.

De Fluiter (H. J.). **Alternaria longipes (Ell. en Ev.) Mason, de verwekker van de bruinvlekziekte in de Besoeki Tabak.** [Alternaria longipes (Ell. & Ev.) Mason, the agent of the brown spot disease of Besoeki Tobacco.]—*Meded. besoek. Proefst.* 59, pp. 1–16, 15 figs., 1938. [German summary.]

In 1937 the Besoeki (Java) tobacco crop was severely attacked by *Alternaria longipes* [*R.A.M.*, xiii, p. 804], the agent of the brown leaf spot disease. The brown lesions on the foliage are zonate, frequently surrounded by a yellow ring, sometimes convergent, and the affected tissues are brittle. Brown, sunken spots may also develop on the veins, petioles, stems, and seeds. This is the first actual record of the disease in the Dutch East Indies, where it has, however, probably long been present without attracting attention.

The fungus was grown in pure culture on plum, cherry, and oats malt agar, of which the two former induced copious mycelial production while the last-named stimulated early and profuse conidial development. Inoculation experiments gave positive results on the following tobacco varieties (in ascending order of susceptibility): Connecticut Shade, Timor, Adonara, Connecticut Shade × 238, Connecticut Shade × 343, Hybrid 238, Kedoe, and Hybrid 343. In the field the Kedoe lines 103, 286, 292, 303, 320, and 322 proved to be the most susceptible, closely followed by Hybrids 238 and 343. The opportunities for infection among these strains are multiplied by their slow maturing habit, necessitating late harvesting. This factor is eliminated in the early ripening cover-leaf types, and it has been observed that crosses Havana 413 with Canary and Hybrids 238 and 343 are much less liable to infection at harvesting.

The mean day temperature in the Besoeki district corresponds with the optimum (25° to 28° C.) for the growth of *A. longipes*, but it is only in relatively dry seasons such as that of 1937 that serious outbreaks are likely to occur. Economic and hygienic considerations preclude the application of chemical treatment to the infected plants, and control

should therefore be based on such cultural measures as timely harvesting, drastic field sanitation, and crop rotation.

Kosmodemianski (V. N.) & Levykh (P. M.). Устойчивость сортов Табака и диких видов **Nicotiana** к поражению **Thielaviopsis basicola** (корневая гниль). [The resistance of some cultivated and wild Tobacco varieties to *Thielaviopsis basicola* (root rot).]—Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна. (ВИТИМ). [*The A. I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], Krasnodar, *Publ.* 132, pp. 5–17, 1936. [Received May, 1938.]

The root rot disease of tobacco due to *Thielaviopsis basicola* [*R.A.M.*, xv, p. 751; xvii, p. 418] is stated to occur in the U.S.S.R. in the Azov-Black Sea Region, Caucasus, and the Ukraine and to cause in some years reductions in yield of over 30 per cent. In the course of three years' experiments on the breeding and selection of disease-resistant varieties, the authors found that some of the varieties, e.g., White Burley from the United States, described as resistant in other countries, proved to be susceptible under Russian conditions. In testing the resistance of plants to the disease the roots were inspected after harvest and the degree of infection registered by a three-mark scale. The results showed that the varieties Dubek 44, American 572 and 8, Varatik 26, and Trebizond 1867, 1865, and 1866 were highly resistant; some of the varieties manifested different degrees of infection in the seed-bed and in the field. The most resistant varieties were found to come from the countries bordering the Mediterranean (western districts of U.S.S.R. including Crimea, Rumania, Bulgaria, Yugoslavia, Greece, and parts of Italy), and the most susceptible from North and South America. Among the wild species of *Nicotiana* tested *N. sanderae* and *N. noctiflora* were immune from the disease, *N. glauca* and *N. repanda* showed high resistance, and *N. glutinosa* high susceptibility.

Boyce (J. S.). **Forest pathology.**—x+600 pp., 215 figs., 1 diag. London, McGraw Hill Publishing Co., Ltd., 1938. Price 30s.

In his preface to this eminently useful and copiously illustrated treatise on forest pathology, the author explains that it is intended to serve both as a text and reference book. The subject is treated mainly from the standpoint of the practical forester, without entering into lengthy taxonomic or morphological discussions of purely academic interest. Following a brief introduction are chapters on disease and fungi in general, non-infectious diseases, seedling diseases, root diseases, foliage diseases of hardwoods and conifers, stem diseases, of both groups, comprising conifer rusts and cankers, hardwood cankers, galls, witches' brooms, fasciations, phanerogamic parasites, and the like, stem decay, rots of various types, deterioration of dead timber and of forest products, and principles of forest-disease control. Each chapter is supplemented by a list of relevant bibliographical references, while appendix A gives brief directions for the preparation of standard fungicides and wound dressings, and B lists the common names of trees with their scientific equivalents.

Koning (H. C.). **Bacterial canker of the Poplar.**—*Chron. bot.*, iv, 1, pp. 11–12, 1938.

The bacterium isolated at the 'Willie Commelin Scholten' Phytopathological Institute, Baarn, Holland, from the slimy exudate of poplars suffering from a special form of canker in the Netherlands, is designated *Pseudomonas rimaefaciens* n.sp. [without a diagnosis]. The disease, which occurs also in Belgium, France, England, and probably Italy, chiefly affects local varieties of obscure origin, such as hybrids of *Populus monilifera* and *P. nigra*, while the balsam group [*P. balsamifera*] is also very susceptible. Poplars in Holland are also liable to occasional infection (sometimes in conjunction with the new bacterium) by *Nectria galligena* [*R.A.M.*, xiv, p. 794]. The bacterial canker may be distinguished from the fungal form by local swellings on the pale-coloured bark, the emission from cracks or lenticels of a slimy exudate, irregularly shaped callus walls, the formation of small, red stripes in the wood, the specially rapid development of infection in the spring, and the radial advance of the pathogen in the wood.

Wolf (F. A.). **Life histories of two leaf-inhabiting fungi on Sycamore.**—*Mycologia*, xxx, 1, pp. 54–63, 14 figs., 1938.

The results of the author's studies showed that the serious leaf blight of the sycamore (*Platanus occidentalis*) in the Duke Forest, North Carolina, is mainly caused by *Stigmina platani* [*R.A.M.*, ix, p. 72], usually in association with *Cercospora platanicola* [printed in error as *C. platanifolia*: see *Mycologia*, xxx, p. 243]. The lesions induced by the latter are the first to become apparent about mid-June, in the form of very irregular, minute, brown, necrotic spots, bearing spores on both sides of the leaf; after the development of the *S. platani* lesions, however, which first appear towards the end of July, the *C. platanicola* fructifications are mostly hypophyllous, and are widely interspersed with those of *S. platani*. Spermogonial and perithecial primordia begin to form concurrently, prior to the abscission of the infected leaves, on the lower leaf surface; the spermatia are liberated for about two months from about the middle of September. It was not possible to establish whether both fungi have spermogonial stages, chiefly because all the spermogonia on the lesions are similar as are also the spermatia, but spermogonia were obtained in pure culture from *S. platani* conidia. The perithecia which attain maturity on leaves which have overwintered in the open are characteristic of the genus *Mycosphaerella*, and are all quite similar in size; they were found, however, to belong to two distinct groups, one with asci measuring 55 to 70 by 9 to 11 μ, containing ascospores 17 to 19 by 6 to 7 μ, and the other with asci measuring 30 to 36 by 7 to 8 μ, containing ascospores 8 to 10 by 4 to 4·5 μ in diameter. In pure culture the first group was shown to belong to *S. Platani*, and as it does not agree with the other species of *Mycosphaerella* recorded on *Platanus* it is described as new under the name *M. stigmina-platani* [with a Latin diagnosis]. The second group agrees well and is believed to be identical with *Sphaerella platanicola* Cooke, and is renamed *M. platanicola* [with a revised Latin diagnosis].

A comparison of *Stigmella platani-racemosae* [*R.A.M.*, ix, p. 347]

with *Stigmina platani* leads the author to consider that the two organisms are closely related; so long as the two form-genera *Stigmina* and *Stigmella* are retained, however, the two species should be regarded as generically distinct (cf. ibid., xvii, p. 137).

Le dépérissement de l'Ailante (verticilliose). [The dying-off of Ailanthus (verticilliosis)].—*Ann. Éc. Eaux For. Nancy*, vi, 2, pp. 303–308, 1937. [English summary on p. 310. Received April, 1938.]

The information herein presented on the dying-off of *Ailanthus glandulosa* in the Paris region due to infection by *Verticillium dahliae* has already been noticed from another source [*R.A.M.*, xv, p. 183].

Nägeli (W.). **Balais de sorcière sur l'Épicéa.** [Witches' brooms on the Spruce.]—*J. for. suisse*, lxxxix, 2, pp. 37–41, 1 fig., 1938.

In connexion with an account of a non-parasitic witches' broom on *Picea excelsa* var. *globosa* in the Chassagne Forest, above the Neuchâtel-La Chaux de Fonds railway, Switzerland, the writer briefly summarizes Tubeuf's studies on the subject of the various types of this malformation on woody plants [*R.A.M.*, xii, p. 663]. Mention is further made of two Swiss observations on the inheritance of witches' brooms, in one of which Schröter (*Schweiz. Z. Forstw.*, p. 52, 1934) found that the seeds of an affected spruce gave rise to a quantity of small plants with dense foliage of the witches' broom type. In the other instance A. Engler states (*Ann. Sta. Rech. for. suisse*, viii, 2) that among the five-year-old progeny of Ringgenberg's 'bushy' spruce, 53 per cent. were definitely globular, 16 per cent. normal, and 31 per cent. displayed transitional characters.

Zyskówna (Zofia). **Przyczynek do flory mikologicznej rezerwatu jodłowego uroczyska Yata w. Nadleśnictwie Państwowym Łuków.** [Contribution to the mycological flora of the Silver fir reserve at Yata in the government forests of Łukow.]—*Trav. Inst. Rech. For. doman. Varsovie*, Ser. A, 21, 27 pp., 15 pl., 43 figs., 1936. [French summary. Received April 1938.]

The author gives a carefully annotated list of 30 fungi (29 Polypores) found on various trees in the silver fir (*Abies pectinata*) [*A. alba*] reserve at Yata, near Łukow, Poland, illustrated with drawings of cystidia and spores of each species and a number of photographs of the sporophores.

Mehlisch (K.). **Ein pilzlicher Schädling an Abies.** [A fungal pest of *Abies*.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 8, p. 92, 1938.

Of recent years *Abies nordmanniana* and *A. nobilis* in German nurseries have been attacked by *Cucurbitaria pithyophila* [*R.A.M.*, vi, p. 202], which produces nodular swellings on the forks of the branches. The fungus, which is characterized by concatenate, cubical spores, also infects *Pinus sylvestris*, *P. cembra*, *P. strobus*, *Picea excelsa* [*P. abies*], and *A. alba*, commonly killing young plants. *P. abies* and *P. pungens* are also liable to invasion by *C. piceae*, causing a snail-like twisting of the buds. Surviving plants slough off the diseased cortex, and are thus left without protection against other fungi and insects. Infected conifers should be removed from the nursery to avoid any further extension of the disease.

ROHDE (T.). **Ueber den Krankheitsverlauf bei der Schweizer Douglasienschütte.** [On the course of the disease in the needle-fall of Douglas Fir.]—*Z. PflKrankh.*, xlviii, 2, pp. 49–57, 1 graph, 1938.

Further studies in south Germany on the Swiss needle-fall of Douglas firs [*Pseudotsuga taxifolia*] caused by *Adelopus gäumanni* [*R.A.M.*, xvii, p. 361] confirmed previous observations as to the ability of the fungus to induce primary infection of the young needles, to which in many cases the initial attacks are, in fact, confined. The whole of the current season's growth is probably seldom, if ever, invaded by *A. gäumanni* in the early stages of its development, though once its virulence reaches a climax it does not spare a single needle of the newly emerging shoots. In this respect the agent of Swiss needle-fall presents a striking contrast to *Rhabdocline pseudotsugae*, which from the onset attacks a high proportion of the needles but almost invariably leaves a certain number untouched, even in epidemic outbreaks of infection. Further investigations have been initiated to determine the exact extent to which the older Douglas fir needles are involved in infection by *A. gäumanni*.

JUMP (J. A.). **A new disturbance of Red Pine.**—*Science*, N.S. lxxxvii, 2250, pp. 138–139, 1938.

Pinus resinosa in the north-eastern section of the United States has been affected since 1933 by a condition, thought to be of fungal origin, characterized by the extra-seasonal growth of one or more lateral buds in the terminal bud-cluster and the subsequent 'forking' of the tree. The precocious laterals assume a more vertical position than normal, and the renewed growth of the terminal bud results in the forked appearance. The forked branch as a rule fails to unite on its upper surface with the bole, and a resinous pocket, surrounded by discoloured wood, usually occurs at the area of non-union, forming an ideal environment for fungi.

Representative plots from some 800 acres of *P. resinosa* 5 to 25 years old showed 68 to 94 per cent. of the trees to be affected. The condition, which is seldom permanent, occurs on soils varying in P_H value from 4·5 to 7·5, and in texture from sandy to clay loam. It occurs in young natural reproduction as well as in plantations, and is found in both mixed and pure stands. Evidence at hand strongly suggests a fungus as the cause of the disease, but further investigations are in progress.

BUCHANAN (T. S.) & KIMMEY (J. W.). **Initial tests of the distance of spread of infection on Pinus monticola by Cronartium ribicola from Ribes lacustre and R. viscosissimum.**—*J. agric. Res.*, lvi, 1, pp. 9–30, 2 diags., 8 graphs, 1938.

The results of observations since 1928 on the spread of white pine blister rust (*Cronartium ribicola*) [*R.A.M.*, xvii, p. 360] from artificially established and maintained infection foci on *Ribes lacustre* or *R. viscosissimum* in stands of naturally regenerating western white pine (*Pinus monticola*) in British Columbia indicated that these two species of *Ribes* are capable of spreading essentially equal infection to the adjacent pines per foot length of live stems. Within a circular acre averages of six tests with *R. lacustre* showed that infection from 155·8 ft. live stems resulted in 7·5 per cent. of the pines becoming infected in a single year, 2·9 per cent. of the trees suffering sufficient damage to

prevent those trees from reaching merchantability, the corresponding figures for *R. viscosissimum* being 88·5 ft., 4·5 per cent., and 2·3 per cent.; the results obtained on the individual plots, however, showed no direct or consistent relationship between the number of feet of live stem and the resultant pine infection for either of the species, owing to the multiplicity of factors involved. Under the conditions of the tests infection spread to a distance of at least 150 ft. from the foci (up to about 250 ft. for *R. viscosissimum*), and was most intensive close to the infected currants, falling off to relatively low values at a distance of 50 to 60 ft. from them; the percentage of damage caused by the rust to the pines followed a similar curve of reduction with increasing distance from the infection foci. It is calculated that, under conditions comparable to those of the tests, it is possible for as little as 14·4 ft. of *R. lacustre* live stems and 31 ft. of *R. viscosissimum* stems to be responsible for damage to 2·8 and 5·6 per cent., respectively, of the regenerating pines.

The results of the investigation indicate the necessity of the eradication of both *Ribes* species in regions to be reafforested with *P. monticola*, and under some conditions at least the eradication should be done with extreme thoroughness.

BOSWELL (J. G.). **The biochemistry of dry-rot in wood. III. An investigation of the products of the decay of Pine wood rotted by Merulius lachrymans.**—*Bio-chem. J.*, xxxii, 2, pp. 218–229, 1938.

Continuing his studies (begun in collaboration with E. C. Barton-Wright) on the biochemistry of *Merulius lacrymans* [*R.A.M.*, x, p. 635] at Sheffield University, the writer fully describes and tabulates the results of his analyses of the constitution of the cellulose-containing, water-, and dilute alkali-soluble fractions prepared from two samples of pine (probably *Pinus resinosa*) panelling, one more severely rotted than the other. The early stages of the attack on cellulose were clearly shown to be hydrolytic, the process being extremely rapid even in its initial phase. In the more severely decayed sample the cellulose content had fallen to 14·83 per cent. and the lignin risen to 40·42 per cent. compared with 60·48 and 23·17 per cent., respectively, in a control sample of sound wood, the corresponding figures for the less extensively rotted wood being 28·81 and 27·61 per cent., respectively. The molecular size of the final product of cellulose hydrolysis is uncertain, but there are indications that it is not smaller than a trisaccharide. Certain reducing compounds were isolated from the water-soluble fraction, possibly (together with the alcohol-soluble material) representing intermediate stages in the respiration of the fungus, though they may be waste products.

RABANUS (A.). **Beitrag zur laboratoriumsmässigen Prüfung von Holzschutzmitteln.** [A contribution to the testing of timber preservatives by laboratory methods.]—*Angew. Bot.*, xix, 6, pp. 579–586, 2 graphs, 1938.

The writer describes and discusses the results of tests by the standard toximetric method of the efficacy of three wood preservatives, basilit N extra, basilit U, and basilit UA [*R.A.M.*, xvi, p. 503], against

Coniophora cerebella [*C. puteana*] on pine and beech, *Lenzites abietina* on pine, and *Polystictus versicolor* on beech, and (with the last-named preparation only) *Polyporus vaporarius* [*Poria vaporaria*], *Lentinus squamosus*, and *Merulius domesticus* [*M. lacrymans*]. Basilit UA (containing arsenic in addition to sodium fluoride and dinitrophenol) was found to be much more resistant than basilit N extra to leaching-out, and the duration of life of telegraph poles and railway sleepers treated with the former should therefore considerably exceed the average of 16 years estimated for the latter. Basilit U (containing bichromate) will probably occupy an intermediate position between the two foregoing. Basilit UA should be applied at the rate of 4 kg. per cu. m.

Ferguson (W.). **Boron deficiency in Cauliflower.**—*Sci. Agric.*, xviii, 7, pp. 388–391, 2 figs., 1938.

When Early Snowball cauliflowers were grown in nutrient solutions containing 0 to 2 parts per million of boron, the plants not receiving boron became markedly affected as soon as the curd appeared, the smaller leaves round the curd being deformed, twisted, and stunted, and the curd itself remaining almost in a vestigial condition and showing a brown discoloration spreading from the top into the flesh and stalk [*R.A.M.*, xvi, p. 722]. The plants receiving even the smallest amount of boron (0·25 p.p.m.) grew normally. It is concluded that boron applications to the soil may prevent the browning of cauliflower curds prevalent in Eastern Ontario in 1937.

Skuderna (A. W.). **Treatment of Sugar Beet seed.**—Abs. in *Facts ab. Sug.*, xxxiii, 4, p. 38, 1938.

Previous experiments (from 1919 to 1928) on the formaldehyde gas treatment of beet seed generally resulted in some increase of acreage sugar yields. Of late years Minnesota farmers have been treating their seed with ceresan dust (4 oz. per 20 lb.), usually a satisfactory method [? of combating such organisms as *Phoma betae*, *Pythium de Baryanum*, and *Corticium solani*: *R.A.M.*, xvii, p. 90]. In 1937 the following dusts were experimentally tested at Rocky Ford, Colorado: 1937 'Ideal', a 1: 1: 1 mixture of copper carbonate, mercuric chloride, and urea, ground to a fine powder, at the rate of 4 oz. per 15 lb. seed; copper carbonate, same rate; ceresan, same rate: and a mixture of ceresan and copper carbonate (2: 1) 3 oz. per 15 lb. While all the treatments increased the yield, the difference was particularly suggestive in the case of ceresan, the production of the plants from seed disinfected with this substance amounting to 16·83 tons of beets and 6,610 lb. sugar per acre compared with 15·28 and 6,087, respectively, for the untreated controls.

Cleare (L. D.). **Plant legislation in British Guiana and the Caribbean colonies.**—*Agric. J. Brit. Guiana*, ix, 1, pp. 25–38, 1938.

The legislation affecting the import and export of plants and plant products, including fruit and vegetables, at present in force in British Guiana and the British West Indies is summarized in tabular form, so that the restrictions in force with respect to any particular product in the area can easily be ascertained.

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW OF APPLIED MYCOLOGY

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Bennett (C. W.) & Wallace (H. E.). **Relation of the curly top virus to the vector, Eutettix tenellus.**—*J. agric. Res.*, lvi, 1, pp. 31–51, 3 graphs, 1938.

In continuation of this series of studies on the curly top virus of sugar beet [*R.A.M.*, xvi, p. 650; xvii, p. 153] the authors give an account of experiments, the results of which showed that the vector, *Eutettix tenellus*, is able to pick up the virus in one minute's feeding on curly top beets, and that viruliferous individuals can transmit it to healthy plants in one minute's feeding on them; the shortest time, however, in which a leafhopper was able to pick up the virus and transmit it was four hours. Sufficient virus was acquired by non-viruliferous individuals in two days' feeding on diseased beets to give them their maximum infective capacity, but the maximum possible charge of virus (as gauged by inoculation tests with extracts from the leafhoppers) was only attained after longer feeding periods. Fasting for 18 hours prior to feeding on healthy plants decreased the percentage infection produced by viruliferous leafhoppers in the first two 6-minute periods of feeding; the percentage was higher after fasting periods of 15 minutes to 3 hours than after fasts of one to 6 minutes or over 3 hours. Special tests indicated that the virus is present in the blood, salivary glands, alimentary tract, and faeces of infective *E. tenellus*, and is most abundant in the blood. Further experiments showed that both virus content and infective capacity decreased gradually over periods of 8 to 10 weeks, regardless of the initial charge of virus, in viruliferous leafhoppers confined to a very resistant or immune plant, such as the Australian saltbush (*Atriplex semibaccata*) or sweet corn, and that leafhoppers with a low charge of virus, acquired in six hours' feeding on an extract from viruliferous individuals, lost their infective power after 54 days of daily transference to healthy beet seedlings; such individuals, however, regained their infective capacity after a very short feed on diseased beets. These facts are held to prove that if there is any multiplication of the virus in the leafhopper, it is not sufficient to maintain the original virus content, the probability being that the virus does not multiply in the insect. Considerable variations were noted in the capacity of different individuals to transmit the disease, and it was found possible by selective breeding to produce *E. tenellus* strains with higher or lower capacity of transmission than normal. As yet, however, there is no evidence that individuals inherently incapable of transmitting the virus can be developed.

In a separate series of experiments it was shown by test inoculations with extracts from macerated insects that the curly top virus is picked up by eight other species [which are listed] of non-vector insects, and is retained by them for periods ranging from less than one day (*Hercothrips femoralis*) to 21 days (*Aceratagallia californica*) after transference to healthy plants.

Le Clerg (E. L.). **Further studies on the parasitism of Rhizoctonia solani on Sugar Beets.**—*Phytopathology*, xxviii, 2, pp. 152–153, 1 fig., 1938.

Three strains of *Rhizoctonia* [*Corticium*] *solani* isolated from severely damaged potato sprouts in Minnesota and Louisiana in 1935 and 1936 caused appreciable decay of sugar beets [*R.A.M.*, xvii, p. 366] in inoculation experiments, while 25 others induced less extensive rotting. Negative results were given, however, by 116 isolates of the fungus from older potato plants and from sclerotia on the tubers.

Jauch (Clotilde). **Las dos especies de Septoria que atacan el Apio cultivado en la República Argentina.** [The two species of *Septoria* attacking cultivated Celery in the Argentine Republic.]—*Rev. argent. Agron.*, iv, 4, pp. 258–272, 1 pl., 6 figs., 1 graph, 1937.

An account is given of experimental studies the results of which showed that in the Argentine the disease of celery commonly known as 'viruela' [measles] is caused by *Septoria apii* and *S. apii-graveolentis* [*R.A.M.*, xii, p. 196; xvi, p. 584], the latter being the more prevalent, although both organisms may occur on one and the same plant. The leaf spots caused by *S. apii* are irregular, whitish or greyish, surrounded by a reddish-black zone or a narrow dark margin; their size varies from 3 to 10 mm.; when present the pycnidia are only found in the centre of the spots on either side of the leaf, as extremely minute blackish points. Apart from their much smaller size (0·5 to 3·5 mm.), the spots produced by *S. apii-graveolentis* are easily distinguishable macroscopically from the former by the constant presence over the whole of their surface of conspicuous pycnidia, closely crowded together, while those of *S. apii* are mainly isolated. Furthermore, the latter has never been observed to attack the leaf petiole, while this organ remains free from infection with *S. apii-graveolentis* only in the initial stages of the disease or in the case of very slight attack. The pycnidia of *S. apii* are mostly globose, and from 58 to 95 μ in diameter, while those of *S. apii-graveolentis* are usually subglobose and 60 to 149 μ in diameter; the pycnospores of the former measure 11 to 43 (mode 29, average 27·4) by 1 to 2·5 μ, and those of the latter 17 to 61 (mode 35, average 36·8) by 1·5 to 3 μ. In hanging drop cultures (potato broth with 2 per cent. glucose) *S. apii* formed a distinctly narrower and more sparsely septate mycelium than *S. apii-graveolentis*, and when transferred to potato agar with 2 per cent. glucose and incubated at 22° C., the former produced larger colonies, bituminous black in the centre with a peripheral pink zone, the whole of the colony sometimes being covered with white cottony mycelium, whereas the latter formed much smaller colonies with a central mass of pycnidia.

Inoculation experiments with monospore cultures indicated that none

of the commercial celery varieties tested was resistant to either species, but the 'para verdeo' variety showed rather less infection than the rest. Neither species was pathogenic to parsley.

Zweigelt (F.) & Voboril (F.). **Die Markkrankheit der Rebe.** [The pith disease of the Vine.]—Reprinted from *Weinland, 1937*, 4–9, 14 pp., 2 diags., 1937. [Received June, 1938.]

Full details are given of a series of inoculation experiments carried out on 62 vines grafted by various methods at Klosterneuburg, Austria, with a fungus, M, consistently associated with the pith disease but differing in certain particulars from *Pumilus medullae* [*R.A.M.*, xvi, p. 587; xvii, p. 432]. The organism is characterized by excessively slender hyphae which traverse the host cells in an almost straight line, with little or no tendency to branching. At a more advanced stage of infection these hyphae may increase in diameter and form a dense network on the inner surfaces of the cell walls, where they give rise to more or less spherical, hyaline, very thin-walled, bicellular spores, which eventually fill the cells. To the same fungus probably belong small, thick-walled, circular spores, occurring here and there in the diseased tissues. In association with M is another fungus, herein referred to as N, the hyphae of which pursue an interrupted or sinuous course through the cells.

The fungus M, either alone or in combination with N, caused virulent infection of the inoculated vines, invariably resulting in death. In nature entry is most likely gained through the zone surrounding the graft union, and in this connexion some practical directions are given for the technique of grafting operations, involving, *inter alia*, the use of stocks and scions with thick, fully matured xylem and a narrow zone of pith.

Du Plessis (S. J.). **The dead-arm disease of the Vine.**—*Fmg S. Afr.*, xiii, 143, pp. 79–80, 83, 4 figs., 1938.

A popular account is given of the dead-arm disease of the vine (*Fusicoccum viticolum*) [*Cryptosporella viticola*: *R.A.M.*, xvii, p. 288], which was brought to the writer's notice in 1935. It chiefly attacks the Riesling, Sultana, Barbarossa, and Flaming Tokai varieties in the Stellenbosch, Somerset West, and Capetown districts. In addition to cultural measures of control, the vines should be given a dormant application of 1 in 8 lime-sulphur, followed by three treatments of the same compound at 1 in 120: (1) and (2) when the shoots are 2 to 4 and 6 to 10 in. long, respectively, (3) just before or during flowering. Copper-sulphur dust or verderame spray (1 lb. in 10 galls. water) may also be used, but are less effective than lime-sulphur.

Du Plessis (S. J.). **The control of Botrytis rot of Grapes.**—*Fmg S. Afr.*, xiii, 143, pp. 81–83, 1938.

The results of the 1937 investigations on the control of *Botrytis* [*cinerea*] wastage in South African export grapes [*R.A.M.*, xvii, p. 470] showed that the best and safest method consists of a single vineyard application of verderame-sulphur dust (80: 20), 14 to 21 days before picking, supplemented preferably by the fumigation of susceptible

varieties with a 4 per cent. concentration by volume of formaldehyde gas, or (where facilities for this process are not available) by spraying the woodwool of each box with 10 c.c. 4 per cent. formalin.

SAINT-CHARLES (R. DE). **Pour obtenir une bouillie mouillante.** [To obtain a wetting mixture.]—*Vie agr. rur., 1938*, N.S., 1, pp. 16–17, 1938.

The writer advocates the addition of the following adjuvants to the standard Bordeaux mixture for the combined control of insects and downy mildew of the vine [*Plasmopara viticola*] in France: diplumbic lead arsenate (500 to 600 gm. per hectol.) and terpenic sulphonated alcohols [*R.A.M.*, xvii, p. 194], known commercially as novemol [ibid., xvii, p. 375], 100 to 200 gm. per hectol., the latter conferring excellent wetting properties on the mixture. A minimum of three applications should be made (1) at flowering, (2) 15 to 20 days later, and (3) 15 days before harvesting. In a footnote it is stated that novemol is also effective against *Oidium* of the vine [*Uncinula necator*], exerting a preventive action when mixed with copper salts and a therapeutic one when simply diluted with water.

STRAŇÁK (F.). **Choroby a poškozeni kulturních rostlin v Čechách ve vegetačním období 1936–1937.** [Diseases of, and injuries to, cultivated plants in Bohemia during the agricultural year 1936–7.]—*Ochr. Rost.*, xiv, 55, pp. 1–4, 1938. [German summary.]

In this briefly annotated list of the most important diseases of cultivated crops in Bohemia, Czechoslovakia, in 1936–7, rye is stated to have suffered very severely from foot rots (*Fusarium* spp.) and from black rust [*Puccinia graminis*], and barley from stripe disease [*Helminthosporium gramineum*]. Heavy outbreaks of potato late blight (*Phytophthora infestans*) were recorded and wart disease [*Synchytrium endobioticum*] was found in several new centres in south, north, and west Bohemia.

Among minor crops, cucumbers were attacked very severely in certain localities by bacterial wilt (*Bacillus tracheiphilus*) [*Erwinia tracheiphila*].

BAUDYŠ (E.). **Zpráva o výskytu chorob a škůdců rostlin v hospodářském roce 1936–1937 na Moravě.** [Report on the incidence of plant diseases and pests in the agricultural year 1936–7 in Moravia.]—*Ochr. Rost.*, xiv, 55, pp. 4–8, 1938. [German summary.]

In 1936–7 autumn-sown cereals suffered severely in Moravia (Czechoslovakia) from foot and root rots (*Fusarium* spp.). Wheats were attacked chiefly by brown rust (*Puccinia triticina*) and to a lesser extent by black rust (*P. graminis*), and barley by stripe disease [*Helminthosporium gramineum*]. Fruit trees throughout Moravia were extensively attacked by various fungal parasites, and in the autumn unharvested grapes in certain localities were severely rotted by *Botrytis cinerea*.

VIELWERTH (V.). **Zpráva o škodlivých činitelích kulturních rostlin v oblasti západního a středního Slovenska.** [Report on the agencies injurious to cultivated plants in western and central Slovakia.]—*Ochr. Rost.*, xiv, 55, pp. 8–16, 1938. [German summary.]

Cereal crops in western and central Slovakia suffered in 1936–7 from

much the same fungal diseases and to an equal extent as in other parts of Czechoslovakia [see preceding abstracts]. Wheat bunt (*Tilletia caries* and *T. foetens*) was, however, less prevalent and less severe than in previous years, and *T. caries*, which occurs alone in the northern districts, did not reach so far south as usual. Stone fruit trees were exceptionally heavily attacked by *Monilia* [*Sclerotinia*] *laxa*, and *M.* [*S.*] *fructigena*; the attack was particularly severe on apricots [see below, p. 536], and observations indicated that the condition was an important factor in the death of an exceptionally large number of young apricot trees from apoplexy, which is stated to be very prevalent in Slovakia. *Botrytis cinerea* was widespread on ripening grapes, the losses caused by it in many localities being estimated at as much as 30 per cent. of the crop [cf. above, p. 499, and preceding abstract].

ŠEDA (A.). **Zpráva o škodlivých činitelích kulturních plodín na východ. Slovensku a Podkarpat. Rusi za hospodářsky rok 1936–37.** [Report on the agencies injurious to cultivated crops in eastern Slovakia and Carpathian Ruthenia in the agricultural year 1936–37.] —*Ochr. Rost.*, xiv, 55, pp. 16–23, 1938. [German summary.]

To judge from this report the incidence and relative importance of diseases of the main cultivated crops in east Slovakia and Carpathian Ruthenia in 1936–7 were much the same as elsewhere in Czechoslovakia [see preceding abstracts]. Potato wart [*Synchytrium endobioticum*] was observed in five new infected areas in the mountain districts of Carpathian Ruthenia.

Plant diseases.—*Rep. Dep. Agric. Punjab, 1936–7*, pp. 52–56, 1938.

During the period under review the gram [*Cicer arietinum*] crop in the Attock District of the Punjab was entirely destroyed by blight [*Ascochyta rabiei*: *R.A.M.*, xv, p. 198] in spite of the destruction or burying of all diseased material from previous crops and the sowing of clean seed. These methods had proved completely effective during the previous three years, but were nullified on this occasion by fresh infection brought in from neighbouring localities by wind and other agencies. No sanitary measures had been adopted in Hazara and Peshawar, and when climatic conditions strongly favour blight, rigorous sanitation cannot save a particular area from subsequent infection from outside tracts where the disease is allowed to develop freely. Three varieties from France were strongly resistant to the attack, and are to be used in breeding work.

Sugar-cane smut [*Ustilago scitaminea*: ibid., xvi, p. 232] has been virtually eliminated at Risalewala by avoiding the planting of setts from affected canes, discouraging the ratooning of affected canes, disinfecting the setts before planting, and roguing out diseased shoots directly they appear.

The fungus responsible for cotton root rot [*Macrophomina phaseoli*: ibid., xvii, p. 34] has now been isolated and identified. Control would appear to be possible by late sowing. Fungal activity first becomes apparent in the wilting of the plants in mid-June, increases up to mid-July, and then gradually diminishes until it finally ceases at the end of September. Infection appears before irrigation is started, but

afterwards becomes much worse, moisture being necessary for the active existence of the parasite. Sowing experiments in badly infected land showed a steady diminution in the severity of the disease with progressive postponement of the sowing date. Plots sown on 25th June gave $4\frac{1}{2}$ to $5\frac{1}{4}$ maunds [369 to 430 lb.] of kapas [*Gossypium herbaceum*] per acre, as against only $1\frac{1}{2}$ maunds [123 lb.] for plots sown on 7th May, the former showing only 4·4 per cent. mortality. This discovery, if verified, will provide means of controlling the disease in badly affected fields.

OSMUN (A. V.). **Department of Botany.**—*Rep. Mass. agric. Exp. Sta., 1937* (*Bull.* 347), pp. 29–37, 1938.

This report [cf. *R.A.M.*, xvi, p. 658] contains the following items of interest. In search of better methods of soil disinfection with old and new disinfectants in the control of diseases of herbaceous ornamentals, W. L. DORAN found that undiluted vinegar worked into or mixed with the soil immediately before seeding at the rate of 200 to 235 c.c. per sq. ft. continued to give satisfactory control of damping-off. The acetic acid (4 per cent.) contained in vinegar seemed, however, to injure crucifers, whereas about 8 c.c. acetic acid (80 per cent.), diluted to 300 c.c. per sq. ft., caused no injury to any of the species of plants tested when seeds were sown immediately after application. Seven c.c. formic acid (90 per cent.), diluted to 300 c.c. per sq. ft. and mixed with the soil immediately before seeding, gave very good control of damping-off, improved germination, and did not interfere with growth; the operator must take care to avoid injury to the skin. An application of 6 to 8 gm. salicylic acid per sq. ft. was usually found to improve germination in the presence of fungi. An application of undiluted pyroligneous acid, made from pine wood, at the rate of about 125 c.c. per sq. ft. immediately before seeding gave good control of damping-off without injury to any of the species tested.

Investigations on the chemical soil treatment against damping-off of vegetables, conducted by W. L. DORAN and E. F. GUBA, showed that the application of chemicals to the soil after seeding was in most cases injurious to seeds. The application of formalin, 1 in 300, at the rate of $1\frac{1}{2}$ pt. per sq. ft., immediately after seeding controlled most of the early damping-off, and was not injurious to tomato, eggplant, pepper [*Capsicum annuum*], or lettuce, although it did injure cress, the only crucifer tested. Vinegar (175 c.c. per sq. ft.) diluted with an equal volume of water, applied after seeding was injurious to cabbage; 220 c.c. per sq. ft. applied in a similar way was not harmful to pepper or several species of *Opuntia* but is not safe for most plants. When different chemical powders were dusted on seed-beds sown with lettuce and cabbage, after firming the soil over the seed, and again upon emergence, the stand of lettuce was improved 11 per cent. over the check with red copper oxide [ibid., xvii, p. 445], 5 per cent. with basi-cop, 1·6 per cent. with vasco, 6 per cent. with calomel [mercurous chloride], 2 per cent. with a 20–80 monohydrated copper-lime dust, and that of cabbage 18 per cent. with vasco, 10 per cent. with zinc oxide, and 15 per cent. with a 20–80 copper-lime dust.

According to the results obtained by E. F. GUBA and C. J. GILGUT in control of apple scab [*Venturia inaequalis*: ibid., xvii, p. 118 and

below, p. 534] the coarsest and the finest wettable sulphurs gave the poorest and the best control, respectively, and severe injury to the foliage was caused only by liquid lime-sulphur. Of the five brands of wettable sulphur compared with the official spray schedule of liquid lime-sulphur and wettable sulphur, linco [ibid., xiv, p. 684] (containing 55 per cent. sulphur) produced no scabby apples, Hood (98·5 per cent. sulphur) 13·3 per cent., magnetic (98·5 per cent. sulphur) 23·8 per cent., flotation (40 per cent. sulphur) 2·5 per cent., and kolofog (30 per cent. sulphur) 8·3 per cent.

The same workers recommend the following seed disinfectants for controlling damping-off of vegetables: red copper oxide for beet, carrot, cucumber, eggplant, lettuce, muskmelon, pepper, spinach, squash, and tomato; semesan for snap beans [*Phaseolus vulgaris*], cabbage, cauliflower, maize, onion, and pea; and zinc oxide for Lima beans [*Phaseolus lunatus*], parsnip, radish, and turnip.

Fiftieth Annual Report of the Kentucky Agricultural Experiment Station for the year 1937. Part I.—67 pp., 1938.

The following items occur in this report [cf. *R.A.M.*, xvi, p. 657]. Blue mould of tobacco (*Peronospora tabacina*) [ibid., xvii, p. 275] is reported for the first time to have caused extensive injury to tobacco beds in Kentucky.

For over ten years tobacco mosaic was controlled on the experimental fields by directing the workmen to use no barn-cured tobacco and to brush out their pockets and wash their hands before handling plants and while setting. In 1937 it was found that 0·55 per cent. mosaic developed when workmen used no barn-cured tobacco throughout the season, 1·6 per cent. when they used it only after setting, and 20·9 per cent. when they smoked or chewed it all the time.

In 1937 a disease similar to brown root rot [see below, p. 560] as described in other States was unusually prevalent in all types of tobacco. Rapid growth did not begin before about 1st August, after which the recovery was remarkable. Different varieties of White Burley tobacco varied considerably in their resistance to the disease, and plants grown on land on which a heavy bluegrass [*Poa pratensis*] sod had been turned under showed little or no disease.

Farm tests of White Burley No. 16 seem to indicate that this new hybrid is more resistant to black root rot [*Thielaviopsis basicola*: ibid., xiv, p. 685 and below, p. 560] than the resistant No. 5, yields 200 lb. more per acre, and is of good quality.

The addition of thallium to sand and water cultures in which Turkish and Burley tobacco plants were growing resulted in varying degrees of chlorosis, which did not, however, appear to be identical with frenching [ibid., xvi, p. 412].

Plant pathology.—*Rep. Ariz. agric. Exp. Sta., 1936–7*, pp. 77–91, 5 figs., 2 diags., 2 graphs, [? 1937. Received May, 1938].

This report includes the following items of interest [cf. *R.A.M.*, xiv, p. 561]. Angular leaf spot of cotton (*Phytomonas malvaceara*) [*Bacterium malvacearum*: ibid., xvii, p. 455] is stated to overwinter in Arizona in the field only on the lint. Delinting with sulphuric acid

applied by machine entirely eliminated the disease and led to quicker germination of the seed (whether selected or gin-run), especially after additional dusting with ceresan, greater ease in handling, planting, and storing of seed, and elimination of 'chopping', while less seed was required per acre.

Verticillium albo-atrum (? *V. dahliae*), isolated from cotton [ibid., xvii, p. 455] from the Safford district, is believed to be the primary cause of wilt in spite of the presence of *Fusarium* in the infected material. Field observations strongly point to seed-borne infection since the disease is apparently not transmitted by soil. Discoloured vascular strands were traced from the roots to the bolls.

No recurrence of the leaf spot of date and other palms caused by *Graphiola* [*phoenicis*: ibid., xvi, p. 23 and below, p. 507] is reported from the date garden near Tempe, which was burned to eradicate the disease. Most of the larger palms and offshoots have survived the burning. Pruning and spraying were found to control the disease in plantings of commercial varieties. In inoculation experiments the incubation period lasted $4\frac{1}{2}$ to 6 months. The scarcity of the disease in date gardens with good aeration indicated that the prevailing low humidity reduces the prevalence of *Graphiola* in the date-growing sections of the State. The effect of spring spraying of date palms for the control of fruit rot caused by various fungi was quite evident on the leaves but showed little difference on the fruit except for the Berhi (Braim) variety. It is concluded that two or more sprayings might well repay the cost.

Both experimental and field tests indicated that for soil treatment ammonium phosphate is superior to ammonium sulphate, which is stated to be at present widely and successfully used in southern Arizona against the *Phymatotrichum* [*omnivorum*] root rot [ibid., xvii, p. 316] of ornamental trees and shrubs. The soil treatment has proved successful on pecan, Arizona ash, pepper tree [*Schinus molle*], beefwood [*Casuarina equisetifolia*], oleander, species of *Pyracantha*, *Cotoneaster*, and *Jasminum*, and Japanese and Californian privets [*Ligustrum japonicum* and *L. ovalifolium*]. In resistance tests some very good strains of Acala cotton showed definite resistance to root rot, but not enough to be of commercial value. The indicator plant (okra) [*Hibiscus esculentus*] revealed some areas of root rot in the Pima nursery.

A fungus causing a serious rhizome rot of iris plants was identified as *Fusarium solani* [ibid., xvi, p. 601] and the identification was confirmed by C. D. Sherbakoff. The rot attacks the secondary roots and stem bases and there is evidence that the fungus can enter through the uninjured epidermis.

Sclerotium rolfsii, first recorded on larkspur [*Delphinium*: ibid., xiv, p. 426] at Phoenix in 1936, was found during the season under survey attacking a small acreage of sugar beets [ibid., xvi, p. 227] between Tucson and Nogales, many miles distant.

Forty-seventh Annual Report for the fiscal year ended June 30, 1937.— *Bull. Wash. St. agric. Exp. Sta.* 354, 90 pp., 1937. [Received May, 1938.]

The section dealing with plant pathology in this report [*R.A.M.*,

xvi, p. 517] contains the following items of interest apart from those already noticed from other sources. F. D. HEALD, C. S. HOLTON, and their collaborators in continued studies on wheat bunt (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetens*]) [ibid., xvii, p. 164] found the 'short smut' race of *T. caries* for the first time in regions around Winchester, Craigmont, and Cottonwood, Idaho, about 75 miles from the Palouse wheat region. The chlamydospores of some races of *T. caries* and *T. foetens* germinated more readily at 18° C., others at 10°, while certain races germinated equally well at either temperature, the time required for germination at any given suitable temperature varying with the race. The chlamydospores of *T. caries* were generally larger than those of *T. foetens* and greater variation in spore size was shown by races of the former than of the latter [cf. ibid., xv, p. 287]. Hybrid spores of crosses between races T_9 and L_8 had some characteristics of each parent and were intermediate for others. Hussar × Hohenheimer, variety C.I. 10068–1, was highly resistant to all races used in testing wheats for bunt resistance. All the Turkey selections tested, except C.I. 11530, were highly resistant to all races except L_8.

F. D. HEALD and R. WELLMAN state that the percentage of blue mould decay in apples [*Penicillium expansum*: ibid., xvi, pp. 189, 757] was correlated with the severity of washing treatment. Commercial tests showed that rinsing with 0·4 per cent. sodium hypochlorite may be expected to reduce markedly the blue mould decay. Experiments showed the feasibility of incorporating certain fungicides in waxes under laboratory conditions and the commercial adaptation of these results is now being attempted.

G. W. FISCHER and his collaborators report considerable varietal resistance and susceptibility in some 50 collections of wheat grasses (*Agropyron* spp.) inoculated with *T. foetens* and *T. caries* [ibid., xvi, p. 90]. It is becoming evident that the mycelium is perennial in the infected perennial grasses; 87 per cent. of the crested wheat grass [*A. cristatum*] plants infected in 1935 showed bunted spikes in 1936 and of those surviving 61 per cent. were again infected in 1937. On the basis of comparative morphology the panicle smut (*Ustilago bromivora*) of brome grasses (*Bromus* spp.), the head smut (*U. lorentziana*) of barley grasses (*Hordeum* spp.), and the head smut (*U. bullata*) of *Agropyron* spp. are stated to represent one composite species evidently comprising numerous physiological races [ibid., xvii, p. 45]. The name *U. bullata* is suggested for this species, which represents the seedling type of infection and probably has a life-history similar to that of *U. avenae*.

Field observations and greenhouse tests with seedling potatoes carried out by L. K. JONES and his collaborators continued to show that of all tested varieties only Katahdin transmits to its progeny resistance to the veinbanding virus [ibid., xvi, p. 828]. In the field 28 out of 1,105 clones developed from selfed Katahdin plants remained free from infection for three consecutive years.

L. K. JONES and F. JOHNSON report that the viruses of enation and severe mosaic of peas [ibid., xvi, p. 651], after ageing *in vitro* beyond their formerly recognized activation period, may still produce infection in plants when the seed is soaked for 24 hours in either virus extract.

L. K. JONES states that the yellow and green mosaic viruses do not affect the growth of the Chief and Latham varieties of brambles [raspberries: ibid., xvi, p. 194] as severely as they do in the case of the Cuthbert variety; the latter has therefore been superseded by the former in the Spokane Valley area.

L. CAMPBELL, F. D. HEALD, and L. K. JONES find that black root and boron deficiency [ibid., xvii, p. 89] constitute two serious diseases of sugar beet in the Puget Sound sugar beet district of Washington. Some 35 different fungi were isolated from black root beets. This disease was found in all the examined fields, amounting to 95 per cent. in fields where beets had been grown for two or more years in succession. Symptoms of boron deficiency, ranging in extent from a trace to over 95 per cent. of the plants, were observed in 67 of about 90 fields examined.

L. K. JONES states that crinkle disease of geraniums [*Pelargonium*] was observed generally in the glasshouses of Washington; affected plants often show extreme dwarfing and crinkling of the foliage, which is chlorotic and develops necrotic spots. Preliminary field and glasshouse tests indicate that a virus may be the causal agent. Another disease of the same host, caused by a virus and named mosaic, was observed in a few greenhouses to produce a mottling of leaves with light and dark green areas often associated with extreme dwarfing of the plant.

BITANCOURT (A. A.). **Brazil: diseases of cultivated or useful plants, observed in the State of São Paulo.**—*Int. Bull. Pl. Prot.*, xii, 3, pp. 49–53, 1938.

This is the second part of the list of diseases of cultivated or useful plants studied at the phytopathological laboratory of the Institute of Biology, São Paulo, from 1931 to 1936 [cf. *R.A.M.*, xvii, p. 299].

ASUYAMA (H.). **New diseases and pathogenes reported recently on the cultivated plants in Japan. IV.**—*Ann. phytopath. Soc. Japan*, viii, 3–4, pp. 231–236, 1938. [Japanese.]

Notes, with bibliographical references, are given on a number of new records of plant diseases and pathogens in Japan [cf. *R.A.M.*, xiv, p. 498], including *Ascochyta italica* on buckwheat, causing brown leaf spot, black rot of sweet potato (*Endoconidiophora* [*Ceratostomella*] *fimbriata*), a virus disease of the mulberry [see below, p. 538], rotting of *Brassica pekinensis* caused by a species of *Corticium*, *Ascochyta lycopersici* causing brown leaf spot of tomato, dry rot of gladiolus corms (*Sclerotinia gladioli*) [ibid., xv, p. 467], rose leaf spot (*Cercospora rosae*) [ibid., xvi, p. 462], carnation ring spot (*Didymellina dianthi*) [ibid., xvi, p. 751] and mosaic [ibid., xi, p. 797], sweet pea spot (*Ascochyta lathyri* var. *lathyri-odorati*) and anthracnose (*Glomerella rufo-maculans*) [*G. cingulata*: ibid., ix, p. 765], cyclamen anthracnose (*G. rufo-maculans* var. *cyclaminis*), and rust (*Uromyces achrous*) of blackwood (*Dalbergia sissoo*).

MALENÇON (G.) & DELÉCLUSE (R.). **Champignons pathogènes observés au Maroc.** [Pathogenic fungi observed in Morocco.]—*Bull. Soc. Sci. nat. Maroc*, xvii, 2, pp. 132–144, 1 pl., 1 fig., 1937.

This list of over 100 fungi parasitic on cultivated plants in Morocco

[cf. *R.A.M.*, xvii, p. 216] contains a number of new or interesting records, of which the following may be mentioned. *Phytophthora palmivora* was first observed on *Cocos campestris* in 1933. *Phoenix canariensis* leaves were found near Rabat in 1936, bearing *Graphiola phoenicis*, which also occurs on date palms [ibid., xii, p. 270] along the coast and on *Chamaerops humulis* near Rabat and Casablanca.

The perfect stage of *Corticium solani* was detected at Salé, in 1936, on native cultures of dwarf mint ([*Mentha*] *nana*), covering the lower surface of the stolons or the stem bases for distances of 20 to 30 cm. It has also been observed on *Gypsophila paniculata* at Casablanca.

Sclerotinia (?) *laxa* was found on apricots near Rabat in 1935.

Cercospora circumscissa on peach leaves [ibid., xvi, p. 492], *C. capsici* on chillies (*Capsicum annuum*) [ibid., xv, pp. 60, 136], *C. medicaginis* [*C. zebrina*] [ibid., ix, p. 319] on lucerne and *Trifolium spinosum*, and *C. resedae* on *Reseda odorata* were detected for the first time in Morocco between 1932 and 1936. Another new record [undated] for the country is *Heterosporium gracile* [? *Didymellina macrospora*] on iris [ibid., xvii, p. 112]. Newly reported species of *Alternaria* are *A. brassicae* (Berk.) Sacc. on cabbage [ibid., xvii, p. 284] and *A. citri* on citrons.

Oospora hyalinula was detected near Rabat in 1933 parasitizing *Fusicladium pirinum* [*Venturia pirina*] on pears. *Mauginiella scaettae*, the agent of a serious disease of date palms in Tunis [ibid., xvii, p. 314], was observed for the first time in south Morocco in 1933. *Entomosporium mespili* [*Fabraea maculata*] was first noticed on quinces [ibid., xvii, p. 188] near Rabat in 1934. Another new parasite of the same host is *Septogloeum cydoniae*, found causing an extensive black discoloration of the fruits and rendering them totally inedible at Port Lyautey.

Bacterium campestre [*Pseudomonas campestris*] was found in 1934 on *Matthiola annua*. *Bacillus carotovorus* [*Erwinia carotovora*] has been found once only, in 1936, on a native planting of carrots.

BRYAN (C. S.). **Identification of Phytomonas, Azotobacter, and Rhizobium or Achromobacter upon initial isolation.**—*Soil Sci.*, xlv, 3, pp. 185–187, 1938.

At the Michigan Agricultural Experiment Station satisfactory differentiation of *Azotobacter* and *Rhizobium* from *Achromobacter* [*Bacterium*] *radiobacter* [*R.A.M.*, xvii, p. 209] and *Phytomonas* [*Bact.*] *tumefaciens* in soil isolations was afforded by the addition to Ashby's agar medium (*J. agric. Sci.*, ii, p. 35, 1907) of 20 c.c. of a 1 in 400 aqueous solution of Congo red (1 in 20,000 final dilution in the medium), under the action of which the subsurface colonies of *Bact. tumefaciens* are coloured red, those of *Azotobacter* pink, and those of *Rhizobium* and *Bact. radiobacter* white.

K. **Erfahrungen über die Bekämpfung des Wurzelkropfes in der Baumschule.** [Observations on the control of crown gall in the tree nursery.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 12, pp. 139–140, 1938.

Some years ago the writer inspected a block of two-year-old dwarf apples grafted on Paradise and Doucin stocks (types IX and V) which

showed nearly 100 per cent. crown gall [*Bacterium tumefaciens*]. The trees were quite unsaleable by reason of the pea- to walnut-sized excrescences caused by the pathogen, but complete recovery took place during the second year after the systematic excision of all diseased material and dipping the roots in a 1 per cent. uspulun-loam emulsion [*R.A.M.*, xiv, p. 499]. Paradise and Doucin slips disinfected in the same way remained free from infection, while those planted out without treatment were severely attacked.

Riceman (D. S.), Donald (C. M.), & Piper (C. S.). **Response to copper on a South Australian soil.**—*J. Aust. Inst. agric. Sci.*, iv, 1, p. 41, 1938.

Along the south-eastern coast of South Australia lie some hundreds of miles of blown calcareous sand containing over 60 per cent. of calcium carbonate in the surface soil and more below, and having a P_H value of 8·5 at the surface and 9·2 at depth. Natural pastures on this land consist almost wholly of inferior annual grasses, rye being the only cereal which can be grown successfully. Wheat, oats, and barley develop severe symptoms of a condition identical with the reclamation disease of north-eastern Europe [*R.A.M.*, xvii, p. 386]; the leaves droop, there is much withering, curling, and death of the tips, and if heading is reached grain is seldom formed. Copper sulphate applications resulted in normal vegetative development and greatly improved grain production.

A wide range of pasture species was sown, but few developed beyond seedling size. Copper sulphate applied at the rate of 28 lb. per acre did not generally prevent their failure, though it caused a slight response in some cases. Under pot culture conditions, however, an apparently normal development of subterranean clover [*Trifolium subterraneum*] was obtained by an equivalent application of copper sulphate.

The evidence indicated that other minor elements may be deficient or unavailable to the plants.

Pichler (F.). **Berechnung der Aufwandmengen bei Trockenbeizen für verschiedene Sämereien.** [Calculation of the quantities of dust required for various kinds of seed.]—*Nachr. SchädlBekämpf., Leverkusen*, xiii, 1, pp. 17–19, 1938. [English, French, and Spanish summaries on pp. 46, 50, and 54.]

Since the amount of dust required for the fungicidal treatment of different kinds of seeds varies for equal weights of seed according to the extent of surface exposed, the author determined the necessary quantities for certain cereal and vegetable seeds [cf. *R.A.M.*, xvii, pp. 332, 406] by comparison with wheat as follows. Wheat requires 200 gm. dust per 100 l. (78 kg.). In order to ascertain the corresponding amount for oats (100 l. $=$ 47 kg.), the volumes for 1 kg. wheat and oats are estimated as $100 : 78 = 1{\cdot}3$ and $100 : 47 = 2{\cdot}1$, respectively, and if the amount of dust for 100 kg. wheat is 200 gm. then the requisite quantity for oats can be calculated from the proportion $1{\cdot}3 : 2{\cdot}1 = 200 : x$, whence $x = 323$; i.e., 100 kg. of oats will require 323 gm. dust. The amounts of dust calculated in a similar way to be necessary for the treatment of 100 kg. barley (four-rowed winter), winter spelt, sugar beet,

large-seeded maize, large peas, beans [*Phaseolus vulgaris*], Italian millet [*Setaria italica*], and French ray grass [*Arrenatherum avenaceum*] are 262, 354, 646, 200, 200, 185, 231, and 969 gm., respectively, the volume of 1 kg. of each being 1·7, 2·3, 4·2, 1·3, 1·3, 1·2, 1·5, and 6·5 l.

STOLZE (K. V.). **Die Lohnsaatbereitung in der Landesbauernschaft Weser-Ems.** [Co-operative seed treatment in the Weser-Ems agricultural district.]—*Nachr. SchädlBekämpf., Leverkusen*, xiii, 1, pp. 1–11, 1 graph, 1 map, 1938. [English, French, and Spanish summaries on pp. 45, 48–49, and 53–54.]

Details are given of the present position in regard to the co-operative treatment of seed-grain in the Weser-Ems agricultural district of Germany [cf. *R.A.M.*, xvii, pp. 20, 100], where a further 67 complete seed-cleaning and -treating depots and 85 disinfection apparatuses are considered to be required in addition to the 447 depots (320 with and 127 without treating equipment) already in existence. At the moment 59 and 43 per cent. of the total amounts required of autumn and spring seed-grain, respectively, undergo fungicidal treatment in 75 per cent. of the Oldenburg depots. In the region under discussion the seed-treating depots are largely (58 per cent.) in the hands of millers; country tradesmen and co-operative societies each own 18 per cent., while the remaining 6 per cent. are variously occupied. Continuous dusting machinery is in operation at most of the depots, but latterly the short (liquid) disinfection process has begun to come into favour.

STAKMAN (E. C.), CHRISTENSEN (J. J.), & BECKER (HANNA). **Pathologische Probleme bei der Züchtung krankheitswiderstandsfähiger Weizen- und Gerstensorten im Sommerweizengebiet der Vereinigten Staaten von Amerika.** [Pathological problems in connexion with the breeding of disease-resistant Wheat and Barley varieties in the Summer Wheat area of the United States of America.]—*Züchter*, x, 3, pp. 59–68, 1 fig., 1938.

The writers summarize and discuss from a theoretical and practical standpoint some of the numerous problems confronting breeders of disease-resistant wheat and barley varieties in the summer wheat-growing area of the United States. Tables are given showing the reaction of 12 summer and 2 winter wheat varieties and 5 of *Triticum durum* to eight diseases, viz., black rust (*Puccinia graminis*), brown rust (*P. triticina*), bunt (*Tilletia* spp.), loose smut (*Ustilago tritici*), ear fusariosis (*Fusarium* spp.), foot rot (chiefly *F.* and *Helminthosporium* spp.), ergot (*Claviceps purpurea*), and black chaff (*Bacterium translucens* var. *undulosum*), and of 11 barley varieties to ten diseases, namely, black rust (*P. graminis*), dwarf rust (*P. anomala*), covered smut (*U. hordei*), false loose smut (*U. medians*) [*R.A.M.*, xvi, p. 737], loose smut (*U. nuda*), stripe disease (*H. gramineum*), ear fusariosis (*F.* spp.), kernel blight (miscellaneous fungi imperfecti and bacteria), helminthosporiosis (*H. sativum*), and mildew (*Erysiphe graminis*) [ibid., xvii, p. 384]. Nearly all the work on which the present survey is based has been noticed from time to time in this *Review*.

Future lines of approach to plant-breeding problems should include studies on the mode of inheritance of resistance, the ecological relations

of a given variety, physiologic specialization within the different pathogens, the influence of environmental factors on infection, the nature and probable limits of resistance, and inoculation experiments in breeding establishments on all hybrid populations with every known physiologic race of the various pathogens involved.

NIGGEMANN (W.). **Methoden zur Messung der Standfestigkeit und ihre Anwendung zur Bestimmung der Faktorenkopplung mit Gelbrostverhalten in verschiedenen Weizenkreuzungen.** [Methods for the measurement of resistance to lodging and their application to the determination of the linkage of factors with reaction to rust in various Wheat crosses.]—*Kühn-Arch.*, xliv, pp. 55–82, 7 figs., 1 diag., 6 graphs, 1938.

The main purpose of the work described in this paper was to establish, in the interest of wheat-breeding for resistance to yellow rust (*Puccinia glumarum*), the existence or otherwise of a linkage between factors for resistance in wheat to lodging and those for reaction to the rust. After briefly indicating the numerous abortive attempts to find a measure of resistance to lodging in the field and in the laboratory, the author states that the apparatus devised by Pech (*Z. Zücht.*, A, xxi, pp. 46–58, 1936) is open to several objections. To obviate these he constructed another apparatus, by which is measured the mechanical resistance to perpendicular pressure of wheat seedlings grown in quartz sand cultures; after having reached a height of about 7 cm., the seedlings are uniformly cut back to 6 cm., and, in groups of 20 seedlings, are subjected to perpendicular pressure exerted by a glass disk surmounted by an aluminium cup into which water is gradually poured from a graduated container; the weight in grams of the water necessary to bring about the collapse of the seedlings is taken as the measure of resistance to lodging, the glass disk and aluminium cup being counterpoised. Controlled tests with this apparatus [which is described in detail] showed that accurate results are obtainable with as few as 125 seeds.

In the investigation of linkage between the factors for resistance to lodging and for rust reaction the two wheat crosses Ridit × Peragis and Ridit × General von Stocken were used. The tests were made on a total of 29,394 plants of known rust reaction, of which 2,783 were studied from the standpoint of resistance to lodging. The results showed the possibility of combining factors for rust resistance with those for resistance to lodging, but the factors for the latter character could not be statistically analysed, though several appear to be involved. The resistance of Ridit to yellow rust in the field is apparently determined by two factors.

SĂVULESCU (T.). **Problém Pšeničných rzi v Rumunsky ve vztahu ke středni Evropé.** [The problem of Wheat rusts in Rumania in its relationship to central Europe.]—*Věstn. čsl. Akad. Zeměd.*, xiv, 4–5, pp. 329–341, 3 graphs, 2 maps, 1938. [German summary.]

The author prefaces this paper by pointing out that the economic losses caused in Rumania by the three main wheat rusts (*Puccinia*

triticina [*R.A.M.*, xvi, p. 19], *P. glumarum* [ibid., xiv, p. 214], and *P. graminis* [loc. cit.]) are much more considerable than is usually recognized, since even in very mild rust years the three diseases account for at least 5 per cent. of the total wheat crop, while in years of severe epidemics, such as for instance 1932, from 40 to 80 per cent. of the wheat may be destroyed by them. Of the three rusts, brown rust alone persists throughout the year on wheat in Rumania, either as uredospores on old stubble or as mycelium in autumn-sown or volunteer wheat plants, from which infection is renewed in the subsequent spring. Black rust infection is to some extent renewed in the spring from barberry bushes, which are still very numerous in the country, where their eradication is not compulsory. The principal sources of infection by all the three rusts, however, are the air-borne spores from the surrounding wheat-growing countries, and observations have established a direct relationship between the direction of the prevalent winds during the critical period for infection and the severity of rust outbreaks in different years.

The author believes that a measure of rust control may be attained by deep ploughing-in of wheat stubble immediately after harvest, followed by a fresh ploughing of the fields just before sowing time, to destroy volunteer wheat plants and weeds, as well as by sowing early maturing wheats; narrow-leaved varieties with relatively low water content are more resistant to the rusts than the broad-leaved and more succulent varieties, and should also be given preference; in his opinion, breeders should strive not so much for high yields as for earliness of maturity. Windbreaks in the field may also afford some protection against wind-borne inoculum.

VIELWERTH (V.). **Vývoj fysiologických forem mazlavé sněti hladké (Tilletia foetens) na středně nachylných Pšenicích.** [The development of physiologic forms of the smooth-spored bunt (*Tilletia foetens*) on moderately susceptible Wheats.]—*Ochr. Rost.*, xiv, 55, pp. 66–70, 1938. [German summary.]

A summarized account is given of experiments extending from 1935 to 1937, in which each of three Czechoslovakian awned wheats (Diosecka No. 2, Sekač No. 17, and Šuranska No. 121), moderately susceptible to bunt (*Tilletia foetens*), was inoculated each year consecutively with spores of the bunt originally collected from the variety under test and also with mixtures of spores from collections on other wheat varieties. The results showed a marked decline in pathogenicity of a given bunt collection when cultured on its own host repeatedly; whereas bunt collections from other wheat varieties, repeatedly grown on any of the three varieties mentioned above, showed increased pathogenicity, both results confirming those of previous work carried out during 1929 to 1934. The investigation is considered to have shown conclusively that the pathogenicity of bunt populations gradually decreases when they are constantly propagated on moderately susceptible wheat varieties, and that the latter play an important selective part in the development of physiologic races of the bunt, two facts which may find useful application in wheat breeding for bunt resistance.

Hiesch (P.). **Erfahrungen über gemeinschaftliche Steinbrandbekämpfung des Weizens bei den Siebenbürger Sachsen.** [Experiments in communal Wheat bunt control among the Transylvanian Saxons.] —*Nachr. SchädlBekämpf., Leverkusen*, xiii, 1, pp. 12–19, 3 figs., 1938. [English, French, and Spanish summaries on pp. 45–46, 49–50, and 53–54.]

Communal wheat seed-grain disinfection for the control of bunt [*Tilletia caries* and *T. foetens*: *R.A.M.*, xvii, p. 382] has been successfully introduced in Transylvania, Rumania. The treatment is carried out with ceresan dust in the Klein-Tillator apparatus [ibid., xiv, p. 519] and members of the Gross-Scheuern agricultural association pay in kind for the use of the fungicidal equipment and material. Three-quarters of the seed-grain required for the total wheat acreage in the district is treated.

Lasser (E.). **Der Einfluss von Licht und Jarowisation auf den Befall von Weizen, Hafer und Gerste durch Tilletia, Ustilago und Helminthosporium.** [The effect of light and vernalization on the infection of Wheat, Oats, and Barley by *Tilletia*, *Ustilago*, and *Helminthosporium*.]—*Kühn-Arch.*, xliv, pp. 161–210, 10 figs., 1938.

A fully tabulated account is given of field experiments, the results of which showed that vernalization of winter wheat grain before sowing in the spring did not increase its yield over that of untreated spring wheats, while vernalization of the seed of the latter produced a reduction in yield. Further tests showed that while vernalization did stimulate the growth of winter wheats and winter barleys, which could thus be induced to form ears in the greenhouse during winter, the process reduced the percentage infection of the seedlings with wheat bunt (*Tilletia tritici*) [*T. caries*] and barley loose smut (*Ustilago nuda*) in artificial infection tests to such an extent as to render them useless in breeding work for resistance to these two diseases.

It was further established that in the work of breeding barley varieties for resistance to *Helminthosporium gramineum* the data obtained from infection tests on barley plants grown in the greenhouse were not reliable, and that the stimulating action of light and temperature did not play an essential part in the infection of oats with loose smut (*U. avenae*), of wheat with bunt or loose smut (*U. tritici*), or of barley with loose smut.

Broadfoot (W. C.) & Tyner (L. E.). **Studies on foot and root rot of Wheat. V. The relation of phosphorus, potassium, nitrogen, and calcium nutrition to the foot- and root-rot disease of Wheat caused by Helminthosporium sativum P.K. & B.**—*Canad. J. Res.*, Sect. C., xvi, 3, pp. 125–134, 1 pl., 1 fig., 1938.

In further greenhouse studies in western Canada on foot and root rots of wheat [*R.A.M.*, xiii, p. 362], wheat seeds were grown in quartz sand with a complete nutrient solution and solutions containing different amounts of mineral elements, and were inoculated with a spore suspension of *Helminthosporium sativum* [ibid., xvi, p. 735], the spore suspension being replaced in the control series by an equal volume of

water. Disease damage was commonly interpreted according to the severity and extent of symptoms, but quantitative measurements of height and weight of the plants were equally satisfactory. Infection increased when the ionic concentration of potassium, nitrogen, and calcium was decreased below that of the complete nutrient solution, but no significant reduction of infection occurred when the concentration of all three elements and phosphorus was increased above that in the complete nutrient solution. Very small concentrations of phosphorus appeared to have no effect at all on the disease. The results show that potassium, nitrogen, and calcium are required in considerable amounts by wheat seedlings if they are to escape excessive damage from the pathogen, and though optimum concentrations for these ions exist, moderate increases above the optimum do not affect the reaction to the parasite. In field practice the same general principles may prove to apply.

When *H. sativum* was grown in pure culture in the same nutrient solutions (plus 2 per cent. dextrose solution) growth was seriously inhibited only in the non-nutrient solution and by the omission or excess of nitrogen, this being most marked with excess of nitrogen in the ammonium form. Of the four elements tested, nitrogen in the nitrate form would appear to be the most important for the growth of the fungus in normal soil.

FELLOWS (H.). **Interrelation of take-all lesions on the crowns, culms, and roots of Wheat plants.**—*Phytopathology*, xxviii, 3, pp. 191–195, 2 graphs, 1938.

The results of greenhouse observations at the Kansas Agricultural Experiment Station from 1928 to 1934, inclusive, on the interrelation of varying degrees of severity of the lesions on the roots, crowns, and culms of wheat plants infected by *Ophiobolus graminis* [*R.A.M.*, xvii, p. 103] are tabulated and discussed. A definite interrelation was established between the presence and severity of lesions on the organs under observation. If one organ alone was diseased, it was usually the root, invasion of which was rapidly followed by an attack on the crown. Increases in the percentage of crown infection were accompanied by (1) increases in root and culm infection, in the severity of the lesions on all parts, in the loss of roots, and in the percentage of dead plants; and (2) decreases in the average height of plants and in the percentages of culms heading and plants tillering. All the plants killed by the fungus and those on which sporulation was observed (29·7 per cent. of the latter were dead) showed infection of the roots, crowns, and culms.

SPRAGUE (R.). **Influence of climatological factors in the development of Cercosporella foot rot of Winter Wheat.**—*Circ. U.S. Dep. Agric.* 451, 40 pp., 2 diags., 13 graphs, 2 maps, 1937.

Foot rot of wheat, caused by *Cercosporella herpotrichoides* [*R.A.M.*, xvii, p. 166], is stated to occur in prairie sections of the Pacific North-West of the United States, where the annual rainfall is 14 to 25 in., and in portions of the Columbia River Basin, where the mean temperature for the growing season is usually between 40° and 45° F. Studies in both field and greenhouse showed that the fungus

throve best in soils with abundant water content, but not near the saturation point. The disease increased with a rise in the relative water content of the soil surface, and it is stated that drying winds have often prevented serious damage. The optimum temperature for the growth of the fungus in the host is about 10° C., but it was able to grow at 6°, while growth was distinctly retarded at 15°. In pure culture the optimum, minimum, and maximum temperatures for vegetative growth were 20 to 21°, 4°, and 30°, respectively. Freezing temperatures were indirectly favourable to the disease by injuring the weaker, smaller culms; light had no noticeable effect on the action of the fungus. Heavy rainfall in spring and early summer helped to bring about destructive attacks of the disease.

Toomre (R.). **Odra ja Nisu lendnõgipeade tõrje.** [The control of Barley and Wheat loose smuts.]—*Agronoomia*, xviii, 5, pp. 357–394, 11 figs., 1 diag., 4 graphs, 1938. [Estonian, with English summary.]

The loose smuts of barley (*Ustilago nuda*) and wheat (*U. tritici*) are stated to be widespread in Estonia, where the average incidence of 2 per cent. may rise in individual cases to over 20 per cent. Very good control of the disease has been obtained by the hot-water treatment, using a special sprinkling apparatus [which is fully described and figured] involving preliminary immersion of the seed-grain for four hours in water heated to 25° C. followed by ten minutes' steeping at 52°. Under proper working conditions the reduction of germination by this method of treatment should not exceed 3 per cent. In order to dry the seed-grain sufficiently for storage it should be exposed for 1½ hours to a temperature of 30°, rising during the next 1½ hours to 50°. For immediate sowing the seed-grain should be dried for 24 hours at 15° to 20°.

Nattrass (R. M.). **Diseases of cereals. IV.**—*Cyprus agric. J.*, xxxiii, 1, pp. 8–10, 2 figs., 1938.

Barley net blotch (*Helminthosporium teres*) [*R.A.M.*, xvi, pp. 20, 443] is one of the most prevalent cereal diseases in Cyprus, usually occurring in conjunction with covered smut [*Ustilago hordei*] and leaf stripe (*H. gramineum*). It appears in winter and early spring on nearly all barley crops, becoming noticeable when the plants are 4 to 10 in. high. Seed-dusting with some substance, such as agrosan or ceresan, which will control all three diseases is recommended, as none is at present important enough to require specific control.

Isenbeck (K.). **Die Bedeutung der Faktoren Temperatur und Licht für die Frage der Resistenzverschiebung bei verschiedenen Sommergersten gegenüber Helminthosporium gramineum. Ein Beitrag zum Anlage-Umwelt-Problem.** [The importance of the factors temperature and light in connexion with the question of the variation of resistance in various spring Barleys to *Helminthosporium gramineum*. A contribution to the constitutional predisposition—environment problem.]—*Kühn-Arch.*, xliv, pp. 1–54, 1 diag., 2 graphs, 1938.

This is a detailed and fully tabulated account of the author's con-

tinued studies on *Helminthosporium gramineum* on barley in Germany [*R.A.M.*, x, p. 231], with particular reference to the effect of temperature and light on the resistance of barley plants to the stripe disease and on the development of the pathogen in the infected plants. Material for artificial inoculations (made by germinating unhulled barley seeds in Erlenmeyer flasks under cultures of the fungus on sterilized wheat grains) was collected in 1933 from all over Germany, where in that year the most widely sown spring barleys, e.g., Eglfinger Hado, Streng's Franken, Müller's Franken, Isaria, and Bavaria, were reported to have been fairly severely attacked by the disease, and to be in general more susceptible to it than winter barleys. Single-spore isolations from this material showed a very considerable variation in the type of growth and colour of the colonies obtained, and these two characters were not reliable for determining the origin of the strain studied. Of 451 pure lines of *H. gramineum* thus developed, 23 were selected as the most representative for Germany, and were used in further work, together with two strains received from Minnesota. The results of preliminary pathogenicity tests gave a clear indication that these 25 pure lines may be divided into six race groups differing in their reaction on five spring barley varieties (Heine's Hanna, Heine's 4-rowed, Jassener Landgerste, Cape × Coast 1518, and Morgenrot, a Heil's Franken × Australian Early hybrid) which were used as differential hosts.

The action of temperature and light was tested separately under controlled conditions on the host plants both free from and infected with the pure lines of the pathogen, and on the various pure lines themselves in pure culture on 2 per cent. potato dextrose agar. The results of the temperature series are considered to indicate that with certain barley varieties, at least, the relative rate of growth may be either increased or reduced by fluctuations of temperature. In a special series of experiments it was shown that the optimum temperature for infection by certain pure *H. gramineum* lines varies from one host variety to another; thus, for instance, the optimum temperature for infection by line 3501–11 was 10° C. on Heine's Hanna, Velvet, Heine's 4-rowed, and Nacktgerste, and 5° on Cape × Coast and Morgenrot. The optimum for line 68–1 was 10° on three varieties and 15° on three others. The lines also varied in the rate at which they lost their infective power at higher temperatures: line 118–2 caused 82·7 per cent. infection on Heine's 4-rowed at 5°, and only 5·4 per cent. at 25°; on the same variety line 3501–11 caused 59·6 per cent. infection at the lower and 4·2 per cent. at the higher temperature, while line 68–1 was able to cause heavy infection on highly susceptible varieties, such as Velvet and Nacktgerste, even at the higher temperatures. These results are held to show that while, generally speaking, lower temperatures tend to lower the resistance of the host to the fungus, this effect is largely dependent on the temperature requirements of the *H. gramineum* strain concerned. The results of three series of experiments indicated that exposure of plants already infected to higher temperatures tended to increase the development of the disease, but here again variations in the reaction to temperature were found to be conditioned by the biotypical peculiarities of host and parasite strains.

The results of extensive experiments on the influence of light on the

host plants and on the pathogens showed that, while in general additional lighting stimulated the growth of the former, its effect varied considerably with the different varieties; none of the fungus strains, on the other hand, appeared to be much affected by this factor. The light optimum for maximum infection of a given variety largely depends on its response to certain intensities of light. When natural daylight was insufficient, additional lighting stimulated infection and development of the disease, but only up to a certain limit of total light intensity, beyond which it increased the resistance of the host, especially in rapidly growing barley varieties, such as Morgenrot. Host susceptibility, however, was much less affected by light than by temperature.

THREN (R.). **Kritische Versuche zur Resistenzprüfung der Gerste gegen Flugbrand (Ustilago nuda (Jens.) Kellerm. et Sw.).** [Critical examination of the methods for testing Barleys for resistance to loose smut (*Ustilago nuda* (Jens.) Kellerm. & Sw.).]—*Kühn-Arch.*, xliv, pp. 211–231, 2 figs., 1938.

The results of the experiments described in this paper showed that the frequently considerable losses of infected material in studies on the breeding of barley for resistance to loose smut (*Ustilago nuda*) (involving artificial infection of the barley flowers with the fungus, and more especially by means of the apparatus described by Piekenbrock [*R.A.M.*, vii, p. 435]) are mainly due to the excessive numbers of spores which are introduced into the flowers. Such losses may be to a very great extent minimized by 'diluting' the inoculum (i.e., by using smut spores killed either with ether or by exposure for several hours to dry heat at 150° C., to which from 1 to 5 per cent. of fully viable spores are added), without materially affecting the percentage of infection of the flowers inoculated.

Further experiments showed that the percentages of infection determined in barley smut-resistance tests are for the most part misleading. For practical purposes it is quite sufficient to group the varieties or lines of barley tested into five different classes of susceptibility (from 0 to 4), as used in breeding work for resistance to rusts, with appropriate notation for the intermediate classes. Some further directions are given which are of practical value to barley breeders.

SÉLARIES (P.). **Observations sur le charbon nu de l'Orge.** [Observations on loose smut of Barley.]—*C.R. Acad. Agric. Fr.*, xxiii, 23, pp. 747–751, 1937.

Since 1931 a disquieting increase in the incidence of loose smut of barley (*Ustilago nuda*) is stated to have been observed in Alsace (France), strain 179 being more susceptible to the disease than 142. In a test in which seed-grain of strain 142 was subjected to the standard hot-water treatment (ten minutes immersion at 52° C.) (*a*) on 8th October, 1932, and (*b*) on 8th March, 1933, the percentage of germination in the former lot was 23 at a temperature of 20°, and in the latter 99 and 98 at 20° and 13°, respectively. Rapid drying in the open air after treatment was found greatly to increase germinability (from 23 and 41 to 98 and 98 per cent., respectively, at 20° and 13°). The

temperature of the bath should not be allowed to exceed 52·5°, and a period of ten minutes is ample for the destruction of the fungus; by doubling the duration of treatment, germination was reduced from 98 to 46 per cent. Although no loss of germinability resulted from this method of control in laboratory tests, a 7 to 10 per cent. diminution was observed in the field, even where the operation was carried out with scrupulous care, while up to a week's delay in emergence has also been recorded. The absolute elimination of the smut by the hot-water bath is of particular value in the case of selected stocks destined for reproduction.

NEILL (J. C.). **Trials of agrosan and ceresan.**—*N.Z. J. Agric.*, lvi, 3, pp. 162–163, 2 figs., 1938.

In these experiments seed of Jumbuck, Major, and Solid Shaw Tuscan Wheats, S.A. Chevalier, N.Z. Chevalier, and Cape barleys, Garton's Abundance, Dun, and Algerian oats, and Marrowfat peas was dusted with agrosan G improved and ceresan (1875 A) at the rate of 2 oz. per bush., and sown immediately after treatment and after storage of the dusted seed for periods up to five months. The following results were obtained: wheat stinking smut [bunt: *Tilletia caries* and *T. foetens*], barley covered smut [*Ustilago hordei*] and stripe [*Helminthosporium gramineum*], and loose and covered smuts of oats [*U. avenae* and *U. kolleri*] were completely eliminated by both the dusts whereas untreated seed of the above-mentioned varieties of wheat gave 8·4, 1·3, and 3·9 per cent. bunt, respectively, untreated seed of the three barley varieties 6·2, 3·8, and 0·9 per cent. covered smut and 0·6, 0, and 7·1 per cent. stripe, and controls of the three oat varieties 6·8, 11·2, and 3·7 per cent. smut. A further test with a heavily smutted line of Garton's Abundance oats that gave 18·3 per cent. infection from untreated seed showed only 0·8 and 0·5 per cent. smut in the plants from dusted seed. With the peas germination was improved by 12 to 14 per cent. by both dusts. All the dusted seed showed higher germination in the field than the undusted, though there was no difference in the laboratory.

IVANOFF (S. S.), RIKER (A. J.), & DETTWILER (H. A.). **Studies on cultural characteristics, physiology and pathogenicity of strain types of Phytomonas stewarti.**—*J. Bact.*, xxxv, 3, pp. 235–253, 1 fig., 1 graph, 1938.

A number of single-cell cultures of *Phytomonas* [*Aplanobacter*] *stewarti*, the agent of striping and wilting of maize and other grasses in the United States [*R.A.M.*, xvii, p. 388], has been studied in respect of various morphological and physiological characters, including pathogenicity.

The conspicuous differences between the cultures after a fortnight's growth on nutrient glucose agar plates at 24° C. permitted their classification in three types. 'A' produced orange-yellow, predominantly smooth, convex colonies of a butyrous consistency, 10 to 12 mm. in diameter, making profuse growth in Ivanoff's selective liquid medium, and inducing in nutrient glucose broth an acid reaction after a week and an alkaline one after four weeks. The cultures of this type were fairly stable and proved highly pathogenic in inoculation experiments

from 1933 to 1935, inclusive, especially on the Golden Gem and Golden Bantam varieties, Country Gentleman being relatively resistant. The colonies of 'B' were lemon-yellow, viscid, sometimes containing an abundance of gum, smooth, raised, about 8 to 10 mm. in diameter, making variable growth in Ivanoff's medium, and inducing an acid reaction in nutrient glucose broth after both one and four weeks' growth. Variable pathogenicity was another feature of this type, the characteristics of which were also liable to change into those of 'C' after prolonged cultivation on artificial media. Type 'C' formed cream-yellow, membranous, smooth, flat colonies, 3 to 5 mm. in diameter, growing well in the selective medium and inducing an acid reaction in nutrient glucose broth after one and four weeks' growth. The pathogenicity of this type was slight and its characteristics stable.

None of the cultures of any type liquefied gelatine, appreciably changed the colour of litmus milk, produced indol, or hydrolysed starch. All induced an acid reaction after a week's growth with glucose, sucrose, levulose, galactose, lactose, glycerol, and mannitol, and no change or an alkaline reaction with maltose, starch, inulin, dextrin, salicin, pectin, and basic media without added source of carbon. Only slight differences in the amount of glucose utilized by the various cultures were observed after three weeks' growth in nutrient broth.

Records of the type of *A. stewarti* cultures found in various localities from 1932 to 1936, inclusive, showed that A was originally isolated only from Eastern-grown material, but later developed sparingly in Middle Western plants, while C was rare and occurred solely in districts where B was prevalent.

A direct relationship was established between the abundance of gum production by certain cultures and their pathogenicity to maize.

No alteration in the taxonomic status of *A. stewarti* is suggested on the basis of these cultural differences.

Spencer (E. L.) & McNew (G. L.). **The influence of mineral nutrition on the reaction of Sweet-Corn seedlings to Phytomonas stewarti.**—*Phytopathology*, xxviii, 3, pp. 213–223, 3 figs., 1938.

The influence of nitrogen, phosphorus, and potassium nutrition on the reaction of Golden Bantam maize seedlings to *Phytomonas* [*Aplanobacter*] *stewarti* [see preceding abstract] was studied at the Rockefeller Institute for Medical Research, Princeton, New Jersey, notes on the degree of infection being made ten days after inoculation.

Seedlings stunted by high concentrations of the three elements were more severely attacked than those receiving the moderate quantities conducive to rapid growth. A deficiency of potassium was more serious from the standpoint of bacterial wilt infection than a shortage of either nitrogen or phosphorus. Nitrogen deficiency resulted in the development of small necrotic lesions but little or no foliar wilting, whereas an excess of nitrogen gave rise to intense infection, involving the death of about half the seedlings within a fortnight of inoculation. At high phosphorus levels the attacks of *A. stewarti* were characterized, not only by the formation of necrotic lesions (which also developed where this element was deficient), but by dwarfing of the seedlings and general foliar wilting. Either a decline or a rise in the potassium con-

centration, respectively, below or above 40 mg. per 100 c.c. favoured wilting which was severe in seedlings without potassium and increased as the potassium concentration was raised from 40 to 200 mg. per 100 c.c.

It is apparent from these data that mineral nutrition exerts a certain influence, the exact scope of which remains to be determined, on the host-pathogen complex of bacterial wilt of maize.

KOEHLER (B.). **Fungus growth in shelled Corn as affected by moisture.**—*J. agric. Res.*, lvi, 4, pp. 291–307, 3 figs., 1 diag., 1 graph, 1938.

The effect of moisture on the growth of various fungi in maize grain was studied in experiments with unsterilized, uninoculated grains and in pure culture work with surface-sterilized material. Shelled yellow dent maize was placed in wire baskets over solutions of appropriate salts in closed glass bottles and thus stored at constant humidities for 3 months at 70° F. The moisture content of grain stored at a known constant humidity was found to vary in different strains of maize or even possibly in individual kernels. *Aspergillus* spp. [*R.A.M.*, xiv, p. 232] grew at lower degrees of water content than other fungi, *A. glaucus* appearing at 14·3 per cent. water content, *A. versicolor* at 15 per cent., *A. wentii* at 15·4 per cent., *A. ochraceus* at 15·6 per cent., and *A. flavus* and *A. niger* [ibid., xiii, p. 572] at 18·3 per cent. Of the *Penicillium* spp. [loc. cit.] causing the 'blue-eye' condition of grain *P. notatum* [ibid., xvi, p. 558] appeared at 16·7 per cent. and *P. palitans* [ibid., xiii, p. 233] at 19·5 per cent. water content; an increase in moisture intensified the development in each case. *Fusarium moniliforme* [*Gibberella moniliformis*: ibid., xvi, p. 806] grew at minimum water contents varying between 18·4 and 21·2 per cent., demonstrating the variability of the different strains of this fungus. At over 23 per cent. this fungus often predominated over all others except when *Diplodia zeae* [ibid., xvii, p. 238] was present; the latter appeared first at 21·2 per cent., but at over 23 per cent. was predominant over all the other fungi. *Gibberella zeae* grew at 22·2 per cent. and competed vigorously with other fungi at 26 per cent. *Nigrospora sphaerica* [ibid., x, p. 644] grew at 22·5 per cent. but was a poor competitor. *Cephalosporium acremonium* [ibid., xvi, p. 168] was not observed on unsterilized grain, but grew at 23·4 to 27 per cent. under pure culture conditions. Fungous growth resulted in commercial damage to the grain when the water content was about 1½ to 2 per cent. higher than the lowest moisture limit for growth.

Head smut in Maize.—*N.Z. J. Agric.*, lvi, 3, p. 184, 1 fig., 1938.

Samples of maize from the vicinity of Gisborne, New Zealand, were found to be infected by head smut [*Sorosporium reilianum*: *R.A.M.*, xvii, p. 347], which seems to have been present in the district for some years, and to be fairly widespread. A thorough survey of the position is being made.

BRYAN (O. C.). **Deficiency symptom patterns in Citrus.**—Reprinted from *Citrus Ind., 1938* (March), 5 pp., 2 figs., 1938.

The author gives summarized notes on the symptomatic patterns produced on the leaves of oranges, grapefruit, and tangerines by deficiency of nitrogen, phosphorus, potassium, calcium, magnesium, iron,

copper, zinc, manganese, and boron. These patterns are illustrated, and their use in practice explained. The paper concludes with some general recommendations on treatment, and there is a bibliography of 15 titles.

PARK (M.). **Citrus canker and its control.**—*Trop. Agriculturist*, xc, 3, pp. 127–135, 1 pl., 1938.

In this account of citrus canker (*Pseudomonas citri*) and its control in Ceylon, already noticed in part from another source [*R.A.M.*, xvii, p. 294], the author states that the disease occurs in most parts of the island, mainly at elevations below 3,000 ft., attacking most severely grapefruit and lime, whereas the mandarin orange and sweet oranges of the Jaffa and the Valencia type and especially lemons are stated to be highly resistant. An eradication campaign on the same lines as in the United States and in South Africa, apart from being costly, would be extremely difficult to carry out in Ceylon, as the disease occurs on many isolated trees in home gardens and on wild species of citrus in the jungle. Many districts in the dry zone are fairly free from infection and they are recommended for the planting of new orchards, for which disease-free stocks or seed should be used. Infected trees within $\frac{1}{4}$ mile of any site on which it is proposed to plant should be burnt; furthermore a careful watch should be maintained against accidental infection by visitors, and when such an infection is discovered the diseased tree should be burned immediately. In already existing orchards the planting of windbreaks, e.g., *Gliricidia*, in every other row at right angles to the prevailing wind is advised for both young and old trees. Thorough picking and burning of diseased leaves at intervals of about two weeks, followed by spraying with colloidal sulphur or lime-sulphur in combination with an insecticide (nicotine sulphate at the rate of $\frac{1}{8}$ to $\frac{1}{4}$ oz. per gal.) effective against the common leaf mining caterpillar (*Phyllocnistis citrella*), which is associated with the citrus canker in a not yet clearly defined way [loc. cit.], is stated to reduce the disease to a very low level in young trees. In old trees the treatment varies with the climate. Picking and burning of diseased leaves and shoots towards the end of the dry season and repeated spraying of young foliage is only recommended in the dry zone; in the wet zone, where there is no marked resting season or period of new growth, the cost of an all-round-the-year treatment would be too prohibitive. Small-scale experiments indicated that the bagging of fruits, just after they have set, in ordinary grease-proof bags protected them to a great extent against infection, and at a later stage against fruit fly attack. It is stressed that regular manuring and a high standard of cultivation should be maintained, when the disease is severe, to make up for the loss of plant tissue through defoliation. Wherever it is possible, and especially in young trees, removal of infected susceptible trees and their replacement with resistant varieties is advocated.

RUGGIERI (G.). **Indagini sulla varietà di Limone 'Monachello'.** [Researches on the 'Monachello' Lemon variety.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 3, pp. 293–304, 7 figs., 1937. [Received May, 1938.]

A survey of the lemon groves in the vicinity of Messina, where 'mal

secco' disease (*Deuterophoma tracheiphila*) [*R.A.M.*, xvi, p. 743] has been present for many years, showed that practically all the fully grown Monachello trees (of which about 40 were found) were in a very good vegetative condition though other varieties in their immediate proximity had either disappeared or had become severely affected. In one locality (much neglected and exposed to the wind), however, the Monachello trees were appreciably diseased. Very young Monachello and Interdonato trees were more commonly affected than the older ones, though the disease appeared to progress very slowly and was not fatal. Taken as a whole, the observations indicated that the Monachello lemon is very highly resistant to 'mal secco' though not immune from it. Infection on this variety appears to progress so slowly that control should be easy and inexpensive.

Matsumoto (T.) & Huzioka (Y.). **Bacteriophage in relation to Bacterium malvacearum E.F.S. I. Preliminary study.**—*Ann. phytopath. Soc. Japan*, viii, 3–4, pp. 193–202, 2 figs., 1938. [Japanese summary.]

The bacteriophage of *Bacterium malvacearum* [*R.A.M.*, xiv, p. 757] was obtained from an aqueous suspension of crushed, diseased cotton leaves kept at 10° C. for three weeks. The potency of the lytic principle was determined by the dilution method and plaque formation on potato dextrose agar. The former demonstrated that the filtrate of three passages gave a titre of 10^{-7}, while the latter showed that a loop of the 1/100 diluted filtrate (seventh passage) produced four plaques, the same quantity of 1/10 filtrate giving 109. Three drops of the latter appeared to be the limit for the accurate counting of the plaques, of which 1,950 were produced.

The highest lytic activity occurred near 28° or between 25° and 28°; it very probably parallels approximately the maximum growth of the homologous bacteria. Probably 37° is near the maximum temperature, while the minimum may be under 10°.

All four strains isolated from the phagic cultures were extremely resistant to lytic action. The pathogenicity of these strains did not differ appreciably, however, from that of the original, as shown by inoculations of detached cotton bolls.

The size of the plaques on the potato dextrose agar varied inversely with the agar concentration, and they grew larger to some extent with an increase in the incubation period.

Andrews (F. W.) & Clouston (T. W.). **Section of Botany and Plant Pathology.**—*Rep. Dep. Agric. For. Sudan Govt, 1936*, Part II, pp. 26–35, [? 1938].

In this report on plant disease work in the Anglo-Egyptian Sudan in 1935–6 [cf. *R.A.M.*, xvi, p. 173] it is stated that blackarm [*Bacterium malvacearum*: ibid., xvii, p. 455] was first reported in the Gezira on new cotton on 1st September, but with some notable exceptions the disease did not cause serious damage. At the Gezira research farm, all the cotton debris was swept up by hand in May, June, and July, collected into heaps, and burnt, after which the plots were heavily flooded, all parts being submerged, and kept under constant observa-

tion; any seedlings that appeared were at once removed. As a result of these measures the ensuing attack of blackarm was one of the lightest recorded. The earliest outbreaks in areas not previously sown with cotton were sporadic, the main infection apparently having arisen from scattered debris and seed cotton, brought in by the natives. An experiment was made to determine whether infected volunteer cotton seedlings or infected cotton debris on old cotton land was the chief source of infection of a new crop. A series of small plots was treated as follows: (*a*) ground spread with infected cotton debris alone, (*b*) the same, the debris being afterwards swept off, (*c*) ground spread with infected debris and flooded for one day with water containing 1 lb. of chloride of lime, (*d*) as the preceding, but flooded for three days, and (*e*) a few widely scattered cotton seedlings were grown in the plot and infected with blackarm by spraying. Parallel to these plots and 10 m. from them, other plots were sown with healthy cotton, so that the prevailing winds and rains blew from the treated plots to the healthy cotton. After a rainstorm, a count showed very conclusively that infection of the new crop was due principally to the artificially infected seedlings, the average percentages of infection in the plots (*a*) to (*e*) being 0·67, 0·32, 1·22, 0·46, and 23·4 per cent. respectively. A striking feature of the experiment was the efficiency of the durra (*Sorghum* spp.) hedges between the treatment plots in preventing the carry-over of the disease from a severely infected plot to an adjacent lightly infected one, in spite of the very poor growth made by much of the durra.

Leaf curl [loc. cit.] in the Gezira area was of negligible importance, except in very localized areas. One-third of the area was sown with the resistant X 1530 cotton, and the continued use of resistant varieties is expected to eliminate the disease shortly.

Wilt [loc. cit.] was not serious in the Gezira. In the past the condition has been attributed to loss of the fine roots, but though wilted plants do possess a poor 'fine root system', it now appears that the primary cause is the rotting of laterals in the subsoil from their distal ends. Fungal attack on the roots was much heavier than in the previous season, 778 fungal isolations being made from 1206 samples of fine roots, including 361 of culture 'XT' type, not yet identified [ibid., xvi, p. 174], 133 of *Pythium* spp., including *P. butleri*, *P. periplocum* [ibid., x, p. 211], *P. afertile*, types near *P. de Baryanum*, and other fungi; from 128 samples of rotted secondarily thickened roots 146 isolations were made, including 85 of the L 47 type (*Rhizoctonia*) and 41 of the 'XT' type.

In experiments on the effect of soil conditions on root and shoot development some improvement was effected by digging the soil 3 ft. deep, firing the top 6 in., mixing this with the next 6 in., and replacing. Puddling the surface of the soil between the ridges after irrigation slightly increased yield. The differences in early growth between plots following salt bush [*Atriplex*] and those following a year's fallow was strikingly in favour of the former. The salt bush markedly reduced the resistance of the soil to mechanical penetration. The evidence obtained indicated that the subsoil in 'wilty' patches was more resistant to penetration than that in wilt-free areas.

As regards numbers of rootlets and extent of discoloration, the X 1530

and 898 cotton varieties were found to be superior to Main Crop Sakel; X 04729 and Multani were about equal to Main Crop, and XH 1229 and Nahdah were inferior.

Records of the incidence of wilt and recovery from it indicated that (1) local soil variations are presumably more important in their effect on the incidence and distribution of wilt than any experimental treatment (sowing date, spacing, manuring, rotation, and the like) on which wilt counts were made; (2) the inclusion of leguminous crops in the rotation and manuring with nitrogenous manures appeared to increase wilt; (3) light, rather than heavy, watering tended to increase wilt; and (4) varietal differences in susceptibility exist.

The final yields of seed cotton given by sets of 50 plants which (*a*) wilted early in November and recovered by the end of the month, (*b*) wilted early in December and recovered by the end of the month, and (*c*) had not wilted by the end of December (controls) were 867, 837, and 1,163 gm., respectively. The produce of the wilted plants was inferior to that of the controls in regularity and toughness of lint, and in lint index and seed weight.

Laboratory inoculations of cotton seedlings with all the chief fungi isolated from cotton roots during the season gave infection of the fine roots by all the fungi tested except L 47, which, however, produced severe rotting of the lower portion of the tap-root in seedlings grown in soil or sand and watered with soil extracts. The growth rate of the seedlings appeared to be unaffected by the root infections, but the leaves of seedlings infected with *Pythium* spp. and *Fusarium* spp. were yellowed. Experimental evidence was obtained that aeration of the soil produced no obvious differences in the amount of root-rotting.

Leaf spot of *Dolichos lablab* caused by *Bacterium phaseoli* [ibid., xiii, p. 565] was generally distributed throughout the early sown crop in the Gezira, but caused no serious damage, the attack being chiefly confined to the lower leaves. At the Gezira research farm all types of *D. lablab* were affected, but only on the plots sown earliest was any appreciable damage done. *Mucuna* spp. and *Desmodium* spp. were not attacked. The pathogenicity of the organism was confirmed by needle inoculations of healthy *D. lablab* plants and spraying with an aqueous suspension of the bacterium. When soil containing leaf and stem debris was flooded for two days the organism was completely eliminated. Transmission of the disease through the seed, probably internally, was indicated by successful inoculations with a decoction obtained by surface-sterilizing and crushing seeds taken from infected pods.

WATKINS (G. M.). **Histology of Phymatotrichum root rot of field-grown Cotton.**—*Phytopathology*, xxviii, 3, pp. 195–202, 1 fig., 1938.

In cases of spontaneous infection of cotton roots in central Texas by *Phymatotrichum omnivorum* [*R.A.M.*, xvii, p. 456], the fungus forms hyphal wefts that grow over the surface of the periderm and often accumulate in the superficial crevices resulting from the rupture and sloughing-off of the outer cork layers. The peridermal cell walls in immediate proximity to the hyphal aggregations soon begin to show modifications in structure, colour, and thickness, presumably due to the chemical action of fungal secretions. These walls also develop

breaks through which the root rot organism can invade the newly opened cell cavity. The centre of the lesion formed by *P. omnivorum* in its gradual progress through the periderm is occupied by a compact hyphal mass containing in its interior the engulfed remnants of partially disintegrated cork walls. After penetrating the phellem, the mycelium rapidly traverses the phelloderm, phellogen, phloem, and cambium, causing extensive cellular collapse, and enters the xylem, where its passage from cell to cell is effected chiefly by way of the pits, the lignified walls being resistant to fungal invasion.

NEILL (J. C.) & TRAVERS (E.). **Prevention of deterioration of tent calico.**—*N.Z. J. Sci. Tech.*, xix, 10, pp. 646–651, 3 figs., 1938.

Experiments on the treatment of tent calico for the prevention of mould deterioration in New Zealand showed that complete protection is afforded by the iron-chromium process, in which the fabric is passed through two baths, the first containing 10 per cent. iron alum and 10 per cent. chromic sulphate (or 20 per cent. chrome-alum), and the second 10 per cent. potassium chromate. The disadvantages of this method are its expense, its inapplicability after making up, and its tendency to discolour the material. Hoyle's proprietary dressing gave a measure of control but permitted the development of small mould colonies imparting a stippled aspect to the calico, while aluminium acetate actually accelerated the disintegration of the fabric. Good control, on the other hand, was obtained by one hour's immersion of the calico in a 1 per cent. aqueous solution of shirlan WS [cf. *R.A.M.*, xvii, p. 212], followed by 24 hours' atmospheric drying. For practical purposes it is recommended that the tent (with ropes) should be immersed in a solution consisting of 1½ oz. shirlan per gal. water; for a single full-sized tent and fly about 10 gals. solution are required, using approximately 1 lb. shirlan, the present cost of which is 9*s.* 6*d.*

The fungi isolated from discoloured calico include species of *Cladosporium*, *Stemphylium*, *Alternaria*, *Pullularia*, *Pleospora*, *Phoma*, *Aspergillus*, *Penicillium*, *Acladium*, *Cephalosporium*, *Rhizopus*, *Mucor*, and *Torula*. Of these, *Cladosporium herbarum* is much the most important, having been uniformly isolated from the brownish-black areas on samples received from all localities, and most readily causing deterioration of the fabric. In marked contrast is the brown, somewhat diffuse spotting caused by *Stemphyllium* and *Alternaria* spp. *Pullularia pullulans* produces a spreading dark stain rather than a spot. *Pleospora* and *Phoma* spp. were usually isolated from material in an advanced stage of deterioration and could only be cultured with difficulty on sterile calico. In nature they produce light brown areas showing concentric rings of black pin-head dots. The other organisms concerned only grow in a saturated atmosphere, and (with the possible exception of *Torula*) do not stain or darken the fabric.

THARP (W. H.). **A sand-nutrient infection technique for the study of Fusarium wilt of Cotton.**—*Phytopathology*, xxviii, 3, pp. 206–209, 1 fig., 1 diag., 1938.

Full particulars are given of the so-called sand-nutrient infection technique for the determination of the varietal resistance of cotton to

wilt (*Fusarium vasinfectum*) [*R.A.M.*, xvii, p. 35] at the Arkansas Agricultural Experiment Station. Twenty-four 3-gal. earthenware jars, with centre drainage holes in the bottom, were equipped with siphon drains for the removal of superfluous moisture and filled to within 2 in. of the top with washed river sand pasteurized at 80° C. Three days before planting the cotton in the jars (of which four were used for each of the six varieties tested) the sand was inoculated with an actively pathogenic isolate of the fungus and an additional inch of moist sand was spread over the surface of each jar before planting 20 sulphuric acid-delinted seeds. The nutrient solution, consisting of 12·5 ml. half molar calcium nitrate and 7·25 ml. of half molar solutions of each of the compounds ammonium nitrate, potassium acid phosphate, magnesium phosphate, and magnesium sulphate, made up to 10 qts with tap water, was added at the rate of 1 qt per jar daily, commencing the day after planting and continuing for the duration of the experiment (26th July to 18th September, 1937). Fresh inoculum was introduced into the soil through an inverted Buchner funnel on the 14th, 21st, and 28th days after planting. During the first five weeks of the test the mean daily air temperature of the greenhouse averaged 29·18°, i.e., near the optimum for infection under the prevailing conditions [ibid., viii, p. 101].

The following counts were made in the final disease analysis 54 days after planting. All the 40 plants of Half and Half (Summerour's) were dead, the corresponding figures for Misdel # 3, Rowden 2088 (Arkansas), Dixie Triumph # 6 (Arkansas), Rhyne's Cook, and Sea Island (Seabrook) being 36, 28, 21, 8, and 0, respectively. All the plants of the two first-named varieties showed external symptoms of the disease, the corresponding percentages for Rowden, Dixie Triumph, and Rhyne's Cook being 95, 85, and 57·5, respectively. Only 11 Sea Island plants were completely healthy, the remaining 29 showing internal discoloration though no outward sign of infection was evident. The first wilt in any variety (Rowden) was recorded on the 21st day and less than a week later all 40 plants of the most susceptible (Half and Half) were showing advanced wilt. Weekly observations were therefore necessary, time being obviously one of the factors concerned in the determination of resistance to this rapidly developing and virulent disease.

Tervet (I. W.) & Esslemont (J. M.). **A fungous parasite of the eggs of the Gray Field Slug.**—*J. Quekett micr. Cl.*, Ser. 4, i, 1, pp. 1–3, 2 pl., 1938.

From unhatched eggs of the grey field slug (*Agriolimax agrestis*) in Scotland the writers isolated a fungus [which is described in detail] having characters in general agreement with those of *Verticillium chlamydosporium* Goddard (*Bot. Gaz.*, lvi, p. 249, 1913) [*R.A.M.*, xiv, p. 392], with which the present organism is accordingly identified. Points of difference include the larger chlamydospore dimensions of the Scottish fungus (36 to 60 by 27 to 37 μ, average 46 by 32 μ), and its capacity to impart a yellow colour to the medium.

In order to test the pathogenicity of *V. chlamydosporium* to eggs at various stages of development, 30 eggs were divided into five groups, of which A was watered with a spore suspension at one day old, B three

days later, C at 8, D at 12, and E at 15 days. None of the eggs of the first three groups developed, three out of six were killed in D, while all survived in the case of E. It would appear, therefore, that the time of infection exercises an important effect on the pathogen, which induces granulation and discoloration of the albumen and nuclear degeneration.

While *V. chlamydosporium* probably exerts a strong natural check on the reproduction of *A. agrestis* in the field (only 19 out of 733 eggs were hatched in a collection made at various times in December, 1936, and January and February, 1937), the possibility of its utilization for biological control purposes is considered to be remote.

BLATTNÝ [C.]. **Parasitace puklice plisněmi na podzimu 1937.** [Parasitization of scale insects by moulds in the autumn of 1937.]—*Ochr. Rost.*, xiv, 55, p. 81, 1938. [German summary on p. 98.]

The author states that over an extensive area in central Bohemia, Czechoslovakia, up to 90 per cent. of the larvae of the scale insect *Lecanium coryli-corni* on plums were killed during the autumn of 1937 by *Cephalosporium lecanii* [*R.A.M.*, xvi, p. 37] and *Cordyceps pistillariaeformis* [ibid., xiii, p. 302], of which the first-named was the more common.

DEBRÉ (R.) & NÉVOT (A.). **Toxicité expérimentale des spores de charbon du Blé (Ustilago nuda f. tritici) chez la Souris.** [The toxicity, in experiments, of Wheat smut (*Ustilago nuda* f. *tritici*) spores to the Mouse.]—*C.R. Soc. Biol., Paris*, cxxvii, 11, pp. 977–979, 1938.

An etiological connexion having been demonstrated in Yugoslavia between the ingestion of smut (*Ustilago maidis*) [*U. zeae*]-contaminated maize and juvenile acrodynia [*R.A.M.*, xvi, p. 675], experiments were conducted at the Bacteriological Laboratory of the Faculty of Medicine, Paris, to determine the effect on mice of infection by loose smut of wheat (*Ustilago nuda* f. *tritici*) [*U. tritici*], introduced into the system either by the consumption of groats mixed with 4 or 8 per cent. spores of the fungus or by the subcutaneous injection of an aqueous spore extract. All the young mice contracted generalized hyperaemia, accompanied in most cases by posterior paralysis and in some by intense pruritus. Adult mice were not adversely affected by the ingestion of smutted groats.

TODD (RAMONA L.). **The life cycle of Cryptococcus hominis.**—*Proc. Ia Acad. Sci., 1936*, xliii, pp. 81–85, 3 figs., 1937. [Received May, 1938.]

The results of the writer's studies at the Department of Hygiene, Preventive Medicine and Bacteriology, University of Iowa, on the life-cycle of *Cryptococcus hominis* [*Debaryomyces neoformans*: *R.A.M.*, xvii, p. 458], a parasite of man, have already been noticed from another source [ibid., xv, p. 802].

DIENST (R. B.). **Cryptococcus histolyticus isolated from subcutaneous tumor.**—*Arch. Derm. Syph., Chicago*, xxxvii, 3, pp. 461–464, 1938.

From a tumour on the tenth rib in a young negress the writer isolated *Cryptococcus histolyticus* [*Debaryomyces neoformans*: see preceding and next abstracts], which proved to be non-pathogenic to laboratory

animals when inoculated intraperitoneally. Subcutaneous abscesses could regularly be produced in rabbits, however, by intracutaneous inoculation, the first positive signs of infection occurring within 48 hours. Since carbohydrate fermentation by *D. neoformans* is a very slow process, it is important to hold subcultures for at least a month before recording reactions.

Cudmore (J. H.). **Torula meningo-encephalitis: a case report.**—*Ann. intern. Med.*, xi, 9, pp. 1747–1752, 4 figs., 1938.

Full clinical details are given of a fatal case of meningo-encephalitis, associated with profuse infection by *Torula* in a 30-year-old white male at the City Hospital, New York.

Cavallero (C.). **Étude expérimentale sur les phénomènes de la variation et de la dissociation de Mycotorula albicans (Robin) Lang. et Tal.** [An experimental study of the phenomena of variation and dissociation in *Mycotorula albicans* (Robin) Lang. & Tal.]—*Boll. Sez. ital. Soc. int. Microbiol.*, x, 2, pp. 36–44, 1938.

In the course of further studies on ten strains of *Mycotorula* [*Candida*] *albicans* [*R.A.M.*, xvii, pp. 176, 394] from various sources the author observed the formation of rough and smooth colonies associated with corresponding modifications in the characters of the organism. The smooth and rough strains were then cultured on media lacking and rich in nutrients, respectively, in order to separate the two types.

Under the experimental conditions, dissociation was gradual and progressive, and became evident in the appearance of intermediate forms possessing the characters of both the smooth and rough variants. This phenomenon was preceded by polymorphism and a pronounced polymetricism of the fungal elements, and occasionally by the development of atypical elements. The variation observed was always accompanied by morphological, biochemical, or pathogenic modification, or by modification in non-specific agglutination reaction.

It is concluded that even if differentiation into rough and smooth colonies is always associated with a variation in the other characters of *G. albicans*, the limits of such variations are extremely wide and cannot be definitely fixed, and that the smooth and rough phases are not altogether analogous with the corresponding phases described by Arkwright for bacteria of the typhus-coli-dysenteric group. While morphological characters vary, but invariably retain certain typical aspects, and fermentative characters also vary, but only within narrow limits, cultural characters and pathogenicity appear to be devoid of systematic value. Differentiation into rough and smooth phases would appear to be due entirely to factors associated with the medium.

Woolley (Mildred T.). **Mycological findings in sputum.**—*J. Lab. clin. Med.*, xxiii, 6, pp. 555–565, 6 figs., 1938.

Of 141 patients at two Arizona hospitals whose sputa were examined for the presence of fungi, 17 yielded positive results. *Monilia* [*Candida*] *albicans* [*R.A.M.*, xvii, p. 320] was detected in eight cases and *M. candida* [*C. vulgaris*: ibid., xvii, p. 395] in one. An *Endomyces* accompanied

C. albicans in one case of pulmonary tuberculosis. The yeast-like organisms were classified on the basis of fermentation tests (in the course of which it was decided that lactose, dextrose, maltose, sucrose, and milk are sufficient for diagnostic procedures) and animal pathogenicity experiments, with satisfactory agreement between the two methods. Of the three *Aspergillus* spp. isolated, two were identified as *A. fumigatus* [ibid., xvi, p. 317] (pulmonary tuberculosis), this organism remaining in the sputa for 2½ years, and one (chronic non-specific pulmonary infection) as *A. niger*. The other organisms found during the survey included *Saccharomyces* sp. and *Torula* [*Torulopsis*] sp., both associated with a single case of sinusitis, and *Coccidioides immitis* [ibid., xvii, p. 394] in three patients suffering, respectively, from pulmonary tuberculosis, coccidiosis, and streptococcal pneumonia.

Turu (H.). **Ueber die aus Perlèche kultivierten Hefepilze.** [On the yeast fungi cultured from perlèche.]—Abs. in *Fukuoka Acta med.*, xxxi, 3, pp. 31–32, 1938.

From the corners of the mouths of 91 patients suffering from perlèche the writer isolated 53 strains of yeasts [*R.A.M.*, xvii, p. 177], of which 2 per cent. were placed, on the basis of their cultural and morphological characters and fermentation reactions, in the *Saccharomyces* group, 75 per cent. in *Myceloblastanon* [ibid., xvii, p. 241], 9 per cent. in *Mycoderma*, and 13 per cent. in *Cryptococcus*. All the 29 strains giving positive results in experiments on rabbits belonged to *Myceloblastanon*, which is evidently the principal agent of the disorder in Japan.

Williams (J. W.). **Reduction and concentration of methylene blue by certain pathogenic fungi.**—*J. Bact.*, xxxv, 3, pp. 305–309, 1938.

The ability to concentrate and reduce methylene blue is an important differential characteristic of certain human pathogens on the study of which the author is engaged [*R.A.M.*, xvi, p. 37]. A 0·001 per cent. concentration of the dye is ideal for the purpose in view. Basically the colour changes appear to be an expression of the oxidation and reduction reactions of the various constituents of the medium.

Fontana (A.). **Alcune ricerche di dermatologia e fitopatologia comparate.** [Some comparative studies on dermatology and phytopathology.]—*G. ital. Derm. Sif.*, lxxix, 1, pp. 19–29, 3 pl., 1938.
Nuove ricerche di dermatologia e fitopatologia comparate. Le acromie. [New comparative studies on dermatology and phytopathology. The achromias.]—Ibid., 3, pp. 335–342, 1 pl., 1938.

Attention is directed towards some striking analogies observed by the writer in his studies in Italy between certain groups of human cutaneous disorders, including various types of ringworm and achromia, and a number of plant diseases of physiological, fungal, bacterial, virus, and animal origin.

Tcherniavsky (I. I.). **Fall von Chromoblastomykose.** [A case of chromoblastomycosis.]—*Vyestn. venerol. derm.*, *1937*, 9–10, pp. 923–925, 1937. [Russian. Abs. in *Zbl. Haut- u. GeschlKr.*, lix, 3–4, pp. 202–203, 1938.]

Injury from a dirty plank on a bridge caused the development on the

leg of a 52-year-old workman of a conglomeration of pink, papillomatous, deep-seated abscesses, centring round a dark brown, spherical, stain-resistant body, the pus of which contained yeast-like cells developing on sugar agar into woolly, black colonies of mycelia and budding cells, the hyphae of the former producing terminal and lateral chains of conidia. The fungus [cf. *Hormodendrum rossicum*: *R.A.M.*, xii, p. 289] proved to be pathogenic to mice and it is suggested that these animals and rats may transmit the disease to man.

FAWCITT (R.). **The roentgenological recognition of certain bronchomycoses involving occupational risks.**—*Amer. J. Roentgenol.*, xxxix, 1, pp. 19–31, 15 figs., 1938.

Aspergillus spp., *Penicillium* spp., *Mucor* spp., and *Botrytis cinerea* were found in the sputa of a number of agricultural workers who had handled mouldy hay, grain, soil, or decaying vegetable matter in the north-west of England, and were suffering from distressing dyspnoea and other respiratory symptoms associated with certain roentgenographic appearances in their lungs. When recognized in an early stage the disease yields to potassium iodide and vaccine therapy. The occurrence of a similar condition was observed in miners of haematite iron ore from whose sputa were isolated *Trichoderma lignorum*, *Penicillium*, *Mucor*, and other fungi; it is thought that fungus infection may possibly be among the factors leading to silicosis. The author considers that fungi play a part, perhaps a major part, in these somewhat obscure, non-tuberculous conditions of the lungs, and it is suggested that the incidence of dust-borne fungi should be considered an occupational risk.

OYAMA (T.). **Vitamin B und Dermatomyceten. I. Mitt. Einfluss des B-Vitamins auf die Dermatomyceten.** [Vitamin B and Dermatomycetes. Note I. The influence of vitamin B on the Dermatomycetes.]—*Nagasaki Igakkwai Zasshi*, xv, pp. 2601–2635, 1937. [Japanese, with German summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lix, 3–4, p. 200, 1938.]

Most of the fungi (*Sporotrichum* and *Trichophyton* spp., yeasts, *Actinomyces*, *Aspergillus*, etc.) under observation at the Dermatological Clinic of Nagasaki University, Japan, responded by a marked increase of growth to the addition to Sabouraud's glucose agar or Fraenkel's medium of 0·5 to 5 per cent. of the vitamin B complex. The mycological features of the cultures underwent no striking change. On vitamin-free media the yeasts were the only group to develop resting stages. Rapid pleomorphism was induced in *Achorion gypseum* by the accessory growth substance.

GOUGEROT (H.) & PATTE (A.). **Pityriasis versicolor réticulé.** [Reticulate pityriasis versicolor.]—*Bull. Soc. franç. Derm. Syph.*, *1938*, 3, pp. 416–417, 1938.

Full clinical details are given of a case of atypical pityriasis versicolor, caused by *Malassezia furfur* [*R.A.M.*, xvii, p. 243], in a 30-year-old metallurgical worker in Paris. The remarkable reticulate distribution of the coffee-coloured lesions along the anastomotic network of the

cutaneous capillaries was closely followed by the aid of Wood's rays, which revealed unsuspected sites of infection and greatly facilitated the diagnosis and treatment of the disorder [ibid., xvii, p. 175].

Marković (A.) & Pantić (M.). **Der Favus im Heere. (Die Art der Behandlung und die erzielten Resultate im Hauptmilitärspitale im Jahre 1935, 1936 und 1937.)** [Favus in the Army. (The manner of treatment and the results secured in the chief military hospital in the years 1935, 1936, and 1937.)]—*Voenn. sanit. Glasn.*, viii, pp. 551–558, 1937. [Serbocroatian, with German summary on p. 556. Abs. in *Zbl. Haut- u. GeschlKr.*, lix, 3–4, p. 202, 1938.]

From 1935 to 1937 the cases of favus in the Yugoslavian Army numbered 151, all being authenticated by clinical diagnosis and microscopic examination, which consistently yielded *Achorion schoenleini* [*R.A.M.*, xvii, p. 395]. Particulars are given of the therapeutic methods (Röntgen epilation) employed in the control of the disorder.

Tanner (F. W.) & Hofer (J. W.). **Thermal death-time studies of Oospora lactis.**—*Food Res.*, ii, 6, pp. 505–513, 1937.

None of the 224 wort agar cultures of *Oospora lactis* [*R.A.M.*, xvii, pp. 179, 245] isolated from cream samples from seven States proved capable of resisting pasteurization in cream at 62·8° C. (145° F.) for 30 minutes in tests at the Department of Bacteriology, Illinois University. Eight out of 144 cultures survived exposure for the same period to a temperature of 57·2° (135°) and none succumbed at 51·7° (125°).

Vallega (J.). **Observaciones sobre la resistencia a la roya de algunos Linos ensayados en el Instituto fitotecnico de Llavallol.** [Observations on the resistance to rust of some Flax varieties tested at the Phytotechnical Institute of Llavallol.]—*Rev. argent. Agron.*, v, 1, pp. 25–56, 1938.

Flax rust (*Melampsora lini*), known in the Argentine [*R.A.M.*, xi, p. 300] since 1883, comprises at least two physiologic races distinct from those occurring in the United States [ibid., xvii, pp. 323, 396], one resembling (according to H. H. Flor *in litt.*) the form of the rust encountered in Uruguay and the other characterized by its pathogenicity to the ordinarily immune Ottawa 770 B. variety. During the last three years the indigenous population of the rust appears to have undergone a change of constitution, as judged by the reaction of certain varieties tested at the Llavallol Phytotechnical Institute, where both Ottawa 770 B. and Italia-Roma, immune in the epidemic season of 1934, have since become susceptible.

Although *M. lini* is a heterothallic fungus, the apparent absence from the Argentine of the aecidial and pycnidial stages of its life-cycle limits the possibilities of the development of new physiologic races through hybridization, and rather suggests their introduction on imported material or the occurrence of mutation. The rust is perpetuated by means of the teleutospores adhering to the stubble or mixed with the seed, while successive cycles of the uredospore stage are completed on diseased plants. Rust infection is favoured by late sowing in a warm, humid atmosphere, which induces the prolific growth neces-

sary to provide an ideal substratum for the parasite. Plants debilitated by adverse physiological conditions or wilt (*F[usarium] lini*) are relatively resistant to *M. lini*.

All the native flax varieties and strains actually under cultivation in the Argentine were shown by the experiments herein described and tabulated to be more or less susceptible to the very virulent endemic races of the rust, among the most resistant being *Z. 195* I.F. 587; *Z. 176* I.F. 586; *Klein 10 e* I.F. 595; *Klein 11 o* I.F. 429; and White-flowered Pergamino Selection 6003 I.F. 474. Of the foreign varieties included in the trials, most of the Indian and Chilean proved to be highly susceptible, while among the more resistant may be mentioned Bombay I.F. 516; Punjab I.F. 869; J.W.S. I.F. 830; T. Tammes flax I.F. 1036; Sorauer Feinflachs I.F. 982; Gillwald's Rica I.F. 842; and Concurrent I.F. 928. Resistance to *M. lini* does not appear from the writer's observations to be correlated with the origin of the material, type of flax (fibre or seed), or flower colour.

Buddin (W.). **The grey bulb rot of Tulips and its control.**—*J. Minist. Agric.*, xliv, 12, pp. 1158–1159, 1938.

In this brief note the author gives the results of further experiments which show that in the control of *Sclerotium tuliparum* [*R.A.M.*, xvi, p. 614] sprinkling the soil after planting the bulbs with a powder containing chloronitrobenzol was unsatisfactory, whereas when the powder was mixed with the surface soil 90 per cent. control was obtained.

Kawamura (T.). **So-called virus diseases of Lily in relation to hosts.**—*Ann. phytopath. Soc. Japan*, vii, 3–4, pp. 163–172, 2 pl., 3 figs., 1938.

In addition to two types of mosaic [*R.A.M.*, xvi, p. 752], namely, green mottling of the leaves and necrotic yellow leaf-streaking, three other types of (presumably) virus disease affect lilies in Japan, viz., 'crook neck' (ascribed by Guterman in the United States to the lily mosaic virus), 'rosette' [ibid., xvi, p. 797], and 'pimple leaf'.

In the summer of 1935 about 50 plants of *Lilium auratum* at Yokohama suddenly became affected with crook neck, though *L. longiflorum* and *L. speciosum* in the immediate vicinity were unaffected. The leaves turned yellow near the apex of the stem, and dried up, assuming a brownish colour; finally complete defoliation occurred, and only a bare, crooked stem, resembling a walking-stick handle remained. No pathogenic organisms were found in connexion with the disease and the tissues appeared to be quite normal.

In true rosette the internodes are shortened, whereas in yellow flat there is a curling down and sometimes a twisting of the leaves, unaccompanied by mottling, streaking, or deformation. The latter type does not always occur among lilies affected with this virus, which sometimes causes the plant to assume a dwarfed or cylindrical shape. In general, the true rosette type is more common than yellow flat; under greenhouse conditions the downward leaf-curling and plant-dwarfing may be reduced, while out of doors these symptoms are strongly marked.

Pimple leaf causes swelling of the leaves and stunting of the plants

on Easter lilies. It has been known in New York for some years, and has also occurred for several seasons on *L. longiflorum* var. *erabu* in greenhouses at Yokohama, where the author formerly confused it with frost injury. In 1936 the condition was observed on *L. longiflorum* in Japan both in the field and in the greenhouse, the flower bud being affected in both cases; the affected plants showed a special deformation of the leaves without mottling or discoloration, but accompanied by severe stunting, as in green mosaic. In pimple leaf the epidermal, and especially the palisade, cells are distinctly swollen, and in many cases lose their chloroplasts.

The paper concludes with a table showing the types of virus symptom (green mottled mosaic, yellow streaked mosaic, yellow flat or rosette, crook neck, pimple leaf, mosaic of unknown symptom, and unaffected) found by the author during a period of several years on 39 lily varieties in Japan.

Săvulescu (T.) & Săvulescu (Olga). **Une espèce d'Uromyces sur les feuilles de Rosa.** [A species of *Uromyces* on the leaves of *Rosa*.]—Reprinted from 'Grigore Antipa' Jubilee Volume, 7 pp., 3 figs., [? 1938].

The following species of *Phragmidium* [*R.A.M.*, xvii, p. 459] have been found on roses in Rumania: *P. disciflorum* [*P. mucronatum*: ibid., xvi, p. 826] on *Rosa canina*, *R. dumetorum*, *R. gallica*, *R. pomifera*, *R. centifolia*, *R. coriifolia*, and *R.* sp., *P. fusiforme* (= *P. rosae-alpinae* (DC) Winter) on *R. pendulina*, *P. rosae-pimpinellifoliae* Diet. on the branches and petioles of *R. pimpinellifolia* (the first record of this species in Rumania), and *P. tuberculatum* J. Miller on *R. canina*.

In 1933 the authors found living leaves of *R. lutea* in Bessarabia bearing on the lower surface the uredosori and teleutosori of a species of *Uromyces*, which they name *U. antipae* n.sp. [with a Latin diagnosis], characterized by globose, ellipsoidal, or elongated, echinulate uredospores measuring 16 to 26·5 by 13 to 16 μ and having 4 to 6 germ pores arranged equatorially; and dark chestnut or dark brown, pulverulent, sparse teleutosori, with variously shaped, generally elongated, often obtuse-angled teleutospores measuring 23 to 33·5 by 16 to 23 μ, provided with a wide, flat, subhyaline papilla at the apex, rounded at the base, surrounded by a finely punctate, brown epispore uniformly 2 to 2·5 μ thick, and borne on a subpersistent, hyaline, thin pedicel 3 to 10 μ long.

Green (D. E.). **Downy mildew on Antirrhinum.**—*J. R. hort. Soc.*, lxiii, 4, pp. 159–165, 2 pl., 4 figs., 1938.

In this expanded account of the writer's studies on downy mildew of *Antirrhinum majus*, reported from southern Ireland in 1936 and from Sussex in 1937 [*R.A.M.*, xvi, p. 815], it is mentioned that some doubt still exists as to the identity of the causal organism with *Peronospora antirrhini*. The oospores of the fungus examined by the writer are larger (30 to 38 μ in diameter) than those described by Schroeter (*Hedwigia*, xiii, p. 183, 1874) for *P. antirrhini* (28 to 32 μ) on *A. orontium*, while the conidiophore mats formed on the under side of the leaves by the British organism are mealy-white to yellowish-brown instead of violet, as originally reported.

Disappointing results were given by experiments in the control of the disease with liver of sulphur, and about 20,000 plants suspected of downy mildew infection had to be destroyed in the Wisley district of Surrey in 1937. Growers are advised to burn affected plants, sterilize the soil in which they were growing, e.g., with 2 per cent. formalin, and treat the remaining healthy plants with Bordeaux mixture or a cupric dust.

Diseases of the Carob tree.—*Cyprus agric. J.*, xxxiii, 1, p. 28, 1938.

Carob trees [*Ceratonia siliqua*] in Cyprus, especially when in a weakened condition, sometimes show leaf and pod infection by *Cercospora ceratoniae* [*R.A.M.*, iv, p. 562], which produces circular spots up to 1 cm. in diameter. The tree is also affected by *Oidium ceratoniae* [ibid., vii, pp. 539, 557], which occurs on leaves and pods and may slightly deform the latter when young. Of the more serious carob diseases, caused by fungi attacking the trunk and main branches, the commonest is *Ganoderma applanatum*.

McKay (R.). **Spraying experiments for the control of Apple scab in 1935 and 1936.**—*J. Dep. Agric. Eire*, xxxv, 1, pp. 42–57, 4 pl., 1938.

In spraying tests carried out in Eire in 1936, three applications of Bordeaux mixture, made with hydrated lime (8–12–100), to Bramley's Seedling apples gave 96·7 per cent. fruits unaffected by scab [*Venturia inaequalis*], as against only 12·5 per cent. clean fruits in the controls. Three and four applications of Bordeaux mixture made with quicklime (3–10–40) gave, respectively, 85 and 98·4 per cent. clean fruits on Bramley's Seedling, while three applications gave 99·3 per cent. clean fruits on Newton Wonder trees. Both types of Bordeaux mixture when applied after petal fall result in injury to the foliage and fruit and two successive years' trials demonstrated that the 8–12–100 formula is altogether unsuited to Irish climatic conditions.

Three and four applications of lime-sulphur (pre-blossom, 1 in 30, post-blossom 1 in 60, and 1 in 80) gave 45·5 to 69·4 per cent. clean fruits on Bramley's Seedling, with no fruit or foliage injury, and on Bismarck 19·7 to 78·9 per cent. clean fruits, as against 99·6 per cent. severely scabbed fruits in the controls. On Allington Pippin three lime-sulphur applications gave 68·1 per cent. clean fruits, as against 19·7 per cent. in the controls. Scab infections on young wood were observed on the Bramley's Seedling and Newton Wonder varieties.

Cheal (W. F.). **Apple scab spraying experiments in the Wisbech area. IV.**—*J. Minist. Agric.*, xliv, 12, pp. 1184–1188, 1 diag., 1938.

Further spraying tests carried out in the Wisbech area of Cambridge since 1934 [*R.A.M.*, xiv, p. 590] have conclusively demonstrated that two heavy pre-blossom applications of lime-sulphur (1 in 80) are, under the conditions prevailing locally, essential for the successful control of apple scab [*Venturia inaequalis*], not only on wood-susceptible varieties but on others also, including Bramley's Seedling. A few days' delay in spraying at the green flower stage is fatal in a year of bad infection.

Report of the Department of Agriculture, Province of Nova Scotia, for the year ended November 30, 1937.—3 pl., 2 graphs, 1938.

The following items are included in this report. In an orchard of Gravensteins and Ribstons at Starr's Point the following were the averages in a ten-year (1928 to 1937) comparative spraying experiment against apple scab [*Venturia inaequalis*]: standard Bordeaux schedule, scab 2·04 per cent., clean fruit 79·11 per cent., bush. per tree 5·23 (excluding 1928); lime-sulphur 3·54, 80·72, and 5·07, respectively; Nova Scotia iron sulphate schedule 3·65, 81·26, and 5·41, respectively (changing from aluminium to iron sulphate in 1933 and to 60 per cent. iron sulphate mixture in 1936); 85–15 sulphur lead dust, 10·77, 69·20, and 6·13 (Gravensteins only), respectively; and untreated 25·45, 49·04, and 5·82, respectively. In 1936–7 at Mount Denson the lowest incidence of scab (3·9 per cent. as compared with 82·80 per cent. in the untreated plots) was obtained on Starks and Baxters with Bordeaux mixture and the highest percentage (89·87) of clean fruit with flotation sulphur. In 1937 copper hydro 40 flotation reduced the amount of scab on Starks from 89·2 to 0·7 per cent., the corresponding figures for lime-sulphur+catalytic sulphur, Bordeaux flotation, lime-sulphur+flotation mixture, lime-sulphur+magnetic mixture, lime-sulphur-wettex mixture, coposil flotation, and lime-sulphur-lead arsenate being 2, 2·8, 2·6, 1·9, 1·9, 1, and 2·9 per cent., respectively. Lime-sulphur-wettex mixture gave the largest amount of clean fruit (94·9 per cent.).

Dunne (T. C.). **'Wither tip' or 'summer dieback', a copper deficiency disease of Apple trees.**—*J. Dep. Agric. W. Aust.*, xv, 1, pp. 120–126, 3 figs., 1938.

Apple trees in Western Australia have for many years been affected by a condition known locally as 'wither tip' or 'summer die-back'. The disease chiefly attacks trees in leached soils, or in soils supporting forests of *Eucalyptus diversicola*. Old and young trees are affected, but in localities where clay layers are present under light surface soils young trees often recover after a few years.

Badly affected trees generally have a stunted, bushy growth habit, due to the inability to develop a leader system. The condition develops as a rule on vigorously growing shoots. Brown spots appear on the terminal leaves in November or December, followed by small necrotic areas; leaves developing subsequently become more severely affected, wither up, and fall. The upper portion of the shoot, to a distance of 3 to 12 in., then withers and dies. The buds on the shoot below the withered part remain healthy, and new growths are frequently produced from the top ones in March. After winter pruning, vigorous growth is generally obtained from shoots whose tips were withered during the previous season.

Of the locally grown commercial varieties Yates is most susceptible, followed by Granny Smith, Jonathan, Cleopatra, and Democrat. Cox's Orange Pippin is usually very badly affected.

In two seasons' tests on Yates and Granny Smith trees copper sulphate applications to the soil [cf. *R.A.M.*, xv, p. 730] at the rate of 2 lb. per tree, trunk (A.R. salt [crystals]) and limb (0·025 and 0·01

per cent. solution) injections, and spraying the leaves with Bordeaux mixture (3–3–40) all produced marked improvement, though similar treatments with zinc and other chemicals had no effect. That the affected trees were suffering from copper deficiency was confirmed by analysis of the leaves of diseased and healthy trees. It is concluded that while spraying with Bordeaux mixture is sufficient to control the condition in young trees, with older trees both soil and spray applications of copper should be made in the first year, followed thereafter by soil applications only.

ROSEN (H. R.). **Life span and morphology of fire blight bacteria as influenced by relative humidity, temperature, and nutrition.**—*J. agric. Res.*, lvi, 4, pp. 239–258, 3 pl., 1938.

In the course of a study on the combined influence of temperature and relative humidity on the fireblight organism *Erwinia amylovora* [*R.A.M.*, xvii, p. 401] the natural bacterial exudate was subjected to a controlled temperature of 16° C., and the bacteria remained viable and infectious for over a year at relative humidities of 0, 9·5, 21, and 45 per cent.; at controlled temperatures of 25°, 30°, 35°, and 40° the bacteria remained viable for long periods when the relative humidity was low, but they died at 45 per cent. saturation. When the exudate was exposed to fluctuating outdoor temperatures the bacteria remained viable for almost a year at relative humidity 0 per cent. and for over 9 months at 50 per cent., but died rapidly at 75 and 90 per cent. Exposed to fluctuating temperatures in the laboratory, the bacteria remained viable for 610 days at a relative humidity of 0 per cent. Bacteria within blighted host tissue lived for approximately the same length of time as those in the natural exudate at low relative humidities, while bacteria in artificial cultures were very short-lived under similar conditions. When minute droplets of exudate were immersed in honey in combs kept outdoors in U.S. Weather Bureau-type housing [meteorological screen] the bacteria were found to be viable after 22 days and dead after 92 days; when bits of blighted host tissue were immersed in honey in the same way the bacteria were viable after 121 days. A morphological study of the organism indicates that bacteria derived from exudate are enveloped in slimy, mainly non-proteinaceous capsules, while in bacteria derived from pure cultures there is either no capsule or only traces of it. It is concluded that the presence or absence of capsules influences the longevity of the bacteria. As to the sources of inoculum for the earliest or primary infection on apple and pear trees, it remains to be determined whether the bacteria are carried over from one year to the next in the form of exudate.

JØRSTAD (I.). **Gymnosporangium on Pomaceous fruits in Norway.**—*Nyt. Mag. Naturv.*, lxxviii, pp. 121–126, 3 figs., 1938. [Norwegian summary.]

All the three species of *Gymnosporangium* occurring in Norway are capable of producing aecidia (*Roestelia*) on the fruits of their respective aecidial hosts, namely, *G. clavariaeforme* on hawthorn (*Crataegus* spp.) and pear, *G. juniperi* on *Sorbus* [*Pyrus*] *aucuparia*, and *G. tremelloides* on apple [*R.A.M.*, xv, p. 609]. In 1937 the last-named was exceptionally

severe in the apple-growing districts of Sogn and Hardanger, producing conspicuous pycnidial lesions at the blossom end of the fruits, especially on the Prinsar, James Grieve, and Torstein varieties, Fillippa, Bramley's Seedling, and Gravenstein being comparatively little damaged. In November the writer received a batch of Signe Tillisch apples with well-developed aecidia of *G. tremelloides* at the blossom end; in some instances *Gloeosporium fructigena* [*Glomerella cingulata*] had produced rotting at the sites of aecidial infection. A consignment of Torsteins showing a similar aecidial development of *Gymnosporangium tremelloides* was submitted for inspection from another locality during the same month, accompanied by a report to the effect that the rust was present on most of the apples used in fruit-packing demonstrations at various places in Sogn, frequently necessitating relegation to inferior grades; Signe Tillisch was the most susceptible variety and the yellow Kaupanger the least so.

The occurrence of *G. clavariaeforme* on pear fruits is very sporadic in Norway, where it has been observed in various districts on the Empress, Bergamotte lucrative, Tongres, and Double Philip varieties. The aecidia are confined to the fruits, which may be attacked both at an early and advanced stage of growth. In 1937 this rust was found in the Botanic Garden at Oslo, for the first time since 1895, on *C. oxyacantha*, *C. macracantha*, and *C. sanguinea* var. *chlorocarpa*, causing pronounced hypertrophy of the berries on the last-named.

GROVES (A. B.). **The relation of concentration of fungicides and bud development to control of Peach leaf curl.**—*Phytopathology*, xxviii, 3, pp. 170–179, 1 fig., 1938.

In a series of experiments from 1933 to 1937 in the control of leaf curl (*Exoascus* [*Taphrina*] *deformans*) on Elberta peaches at the Virginia Agricultural Experiment Station [*R.A.M.*, xvii, p. 255], satisfactory results were obtained by the use of much weaker concentrations of fungicides than those usually recommended. The disease was successfully combated by lime-sulphur 1 in 50, Bordeaux mixture 2–4–100, wettable sulphurs (dry lime, dritomic, dry flotation, and kolofog) 16 lb. in 100 gals., and soluble sulphur (dry sodium polysulphides) 8 lb. in 100 gals.

Sprays of lime-sulphur 1 in 40 applied after the leaves were protruding as much as 1 in. from the buds were effective against leaf curl.

VIELWERTH (V.) & SLINK-MEZENCEVOVÁ (Mme A.). **Pokusy s Moniliovou infekcí Meruněk.** [Experimental infection of Apricots with *Monilia*.]—*Ochr. Rost.*, xiv, 55, pp. 47–50, 1938. [German summary.]

The results of inoculation experiments in 1937 [some details of which are given] showed that *Monilia* [*Sclerotinia*] *laxa* [*R.A.M.*, xvi, p. 623; xvii, p. 441; and above, p. 501] is not able to penetrate the unwounded bark of apricot stems; infections were more numerous when the inoculum was applied to wounds in the bark cut horizontally than when it was applied to longitudinal wounds, indicating that the infective capacities of the fungus are largely dependent on the healing power of the injured tissues. Wound inoculations gave positive results only when

made in the first two weeks of May; later ones (20th May) consistently yielded negative results. These findings are considered to indicate that *S. laxa* is not the primary cause of apoplexy of apricot trees, though the fungus is almost invariably found on dying or dead trees which it enters through the numerous necrotic spots in the bark.

Pohl (H.). **Die Rutenkrankheit bei Himbeeren.** [Cane blight of Raspberries.]—*Obst- u. Gemüseb.*, lxxxiv, 3, pp. 32–33, 1938.

In order to protect raspberry plantings of the valuable Preussen variety against the disastrous effects of cane blight [*Didymella applanata*: *R.A.M.*, xiv, p. 775], German growers are advised to apply to the soil large quantities of lime and related mineral substances, preferably in the form of plant ashes, which usually contain up to 30 per cent. or more lime and a high proportion of potash. The disease chiefly affects old plantings and in severe cases it may be necessary to uproot the infected bushes and replant fresh material on a new site. The Harz Jewel variety appears to combine resistance to cane blight with other desirable characters and should be cultivated in trial plantings to determine its suitability in different types of soil.

Chamberlain (G. C.). **Yellow blotch-curl: a new virus disease of the red Raspberry in Ontario.**—*Canad. J. Res.*, Sect. C, xvi, 3, pp. 118–124, 2 pl., 1938.

Cuthbert red raspberries in Ontario were in 1935 observed to be affected by a disease (presumably present for some years but previously undetected) characterized by reduction in the number of canes and a remarkable dwarfing and stunting. The affected stools were thin, spindly, and lacking in vigour, the canes exhibiting an erect, stiff growth, and bearing pale, chlorotic, lustreless leaves which rattled when the canes were shaken. Owing to shortening of the internodes, especially in the apical parts, the leaflets appeared in a cluster formation, which was accentuated by a loose type of curling, in which the leaves became arched, the tips curling downwards and inwards. On some canes a few of the older basal leaflets showed a coarse, yellow blotching and spotting, often as definite ring spots.

The disease, which is termed 'yellow blotch-curl', was experimentally transmitted in 60 out of 100 attempts by patch-grafting to the Cuthbert, Viking, Latham, Herbert, Chief, and Lloyd George varieties, and is considered to be of virus origin. The various types of symptom expression on these varieties are described in detail. All nine attempts at transmission to black raspberries were unsuccessful.

In all cases where transmission was effected, infection did not become systemic until the second year. Symptoms appeared first on lateral branches, most frequently those nearest the graft. June or early July were the most favourable times for transmission by grafting, and unless grafts were made then, symptoms did not appear on the current season's growth.

Smart (Helen F.). **Microbiological studies on cultivated Blueberries in frozen pack.**—*Food Res.*, ii, 5, pp. 429–434, 1937.

The microbial content of fresh cultivated blueberries (*Vaccinium*

corymbosum) of the Cabot, Concord, Pioneer, Rancocas, and Rubel varieties from New Jersey was found to range from 100,000 to over 1,000,000 organisms per gm., chiefly *Botrytis* sp., *Cladosporium* sp., *Monilia* sp., *Penicillium* sp., *Rhizopus* sp., *Sclerotinia* sp., and three types of yeast, including pink, white, and black species of *Saccharomyces*. Less than 1 per cent. of the micro-organisms survived the storage period of seven months in the frozen berries [cf. *R.A.M.*, xiv, p. 322], but those remaining alive (chiefly species of *Monilia*, *Penicillium*, *Rhizopus*, and *Saccharomyces*) sufficed to cause rapid spoilage of the fruit at room temperature. The wholesomeness of the frozen berries is not impaired by the surviving micro-organisms provided they are consumed reasonably soon after thawing, or transferred to a refrigerator.

ENDO (Y.) & KURASAWA (T.). **On a strange virosis of the Mulberry tree.**—*Bull. Seric. Silk Industr., Uyeda*, ix, pp. 115–132, 4 pl., 6 figs., 1937. [Abs. in *Jap. J. Bot.*, ix, 2, p. (34), 1938.]

The authors state that a virus disease of mulberries is prevalent in various parts of Japan [cf. *R.A.M.*, xv, p. 386] and is characterized by foliar mottling, thickening of the mesophyll, clearing of the leaf veins and interveinal areas, production of enations on the under surfaces of the leaves, complete suppression of the lamina causing filiform development, and clustering of the leaves at the shoot apex. Silkworms cannot be fed on the affected foliage. Diseased trees ultimately cease growth and die. No micro-organisms have been observed in the infected tissues, but various cells were found to contain 'X-bodies'.

BROOKS (C.) & MCCOLLOCH (L. P.). **Spotting of Figs on the market.**—*J. agric. Res.*, lvi, 7, pp. 473–488, 6 figs., 3 diags., 3 graphs, 1938.

Figs poorly refrigerated in transit or held on the market in the United States are liable to develop a surface spotting that seriously lowers their market value. Fruits of all varieties from both the Atlantic and the Pacific coasts are affected. The spotting is largely confined to fully ripe fruit and is favoured by skin cracks and by the sugary solution often found on the surface of the fig. From affected figs the authors isolated mainly *Alternaria tenuis* but also *Cladosporium herbarum* and *Botrytis* [cf. *R.A.M.*, xiii, p. 41]. The strains of *A. tenuis* from Californian and Virginian figs are believed to be distinct, producing slightly different spotting and showing differences in growth in culture. Storage of figs at a low humidity (65 per cent.) entirely prevented the development of the spots, but the fruit became badly shrivelled. *A. tenuis* grew on potato dextrose agar approximately twice as rapidly at 77° F. as at 59°, about twice as rapidly at 68° as at 50°, nearly three times as rapidly at 59° as at 41°, and fully three times as rapidly at 41° as at 32°. Temperature studies with *C. herbarum* yielded similar results. Exposure to 30 per cent. carbon dioxide for 2 days at temperatures of 41°, 50°, 59°, 68°, and 77° delayed the growth of the fungus for about $1\frac{1}{3}$ days, reducing the activity to about one-third of normal. Exposure to an average concentration of 23 per cent. or more carbon dioxide in pony refrigerators gave as good control of the spotting as immediate storage at 32°.

EDSON (H. A.). **United States of America: Cephalosporium wilt of Persimmon.**—*Int. Bull. Pl. Prot.*, xii, 3, p. 53, 1938.

In connexion with the destructive *Cephalosporium* wilt of persimmons (*Diospyros virginiana*) recently reported from central Tennessee [*R.A.M.*, xvii, p. 405], the writer states that the original centre of infection, probably dating from 1933 or 1934, is now entirely devoid of living trees, while in adjacent areas 80 per cent. of the stands are dead and the remainder infected.

BITANCOURT (A. A.). **A anthracnose da Mangueira.** [Mango anthracnose.]—*Biologico*, iv, 2, pp. 43–45, 1 fig., 1938.

In giving a brief popular account of the various lesions caused by *Colletotrichum gloeosporioides* [*R.A.M.*, xvii, p. 403] on the mango and its fruits, the author states that the most dangerous form of attack by the parasite is blossom blight, since in severe cases a tree may lose its entire crop. The disease is not easy to control, especially in highly susceptible varieties. During the dormant season all diseased wood should be removed and burned. Pruning should also afford the maximum aeration and insolation to the crown. Spraying with 1 or 1·5 per cent. Bordeaux mixture should be started as soon as the blossom buds begin to swell, and should be repeated every four days until all the flowers on the trees are fully developed, i.e., over a period of 10 to 15 days under the local conditions in Brazil; one or two applications of the spray should be given after the fruits are set.

WILCOXON (F.) & MCCALLAN (S. E. A.). **The weathering of Bordeaux mixture.**—*Contr. Boyce Thompson Inst.*, ix, 3, pp. 149–159, 1 fig., 5 graphs, 1938.

In continuation of their studies on Bordeaux mixture [*R.A.M.*, xv, p. 733], the authors give an account of experiments to determine the changes that occur in the chemical composition of the spray residue on glass slides during exposure, after drying in the laboratory, to the action of weather conditions out of doors. The main determinations were made with 4–4–50 Bordeaux mixture, which was sprayed on circular glass plates (225 sq. cm. in area) as uniformly as possible for from 30 to 50 seconds, the duration of application being constant for any one experiment. Approximately 1·5 to 4 mg. of copper were thus deposited on each plate. The results indicated that under the leaching influence of rain and dew the spray deposit undergoes a continual change of composition. The excess lime in the mixture is carbonated quite rapidly, after which calcium and sulphate are removed by rain and dew at a greater rate than copper, leaving a residue relatively richer in copper as weathering proceeds. This process is accompanied by an increase in soluble copper, the highest observed amount of which was 0·45 mg. per plate, when the plate was agitated with 50 c.c. of water. Carbonation of the excess lime was complete in a few hours, but the increases in soluble copper did not occur until much later. While these results could be duplicated in the laboratory using artificial rain playing on dried films of Bordeaux mixture, washing the Bordeaux precipitate in bulk by centrifuging or on a Buchner funnel did not lead to substantial

increases in soluble copper. In the dried deposits of Bordeaux mixtures low in lime exposed to the leaching effect of rain, soluble copper appeared sooner than with 4–4–50 mixtures. Treatment of the sprayed films with carbon dioxide, either wet or dry, did not lead to much increase in soluble copper. It is considered that the increases in soluble copper observed can be best explained by assuming that the weathered Bordeaux precipitate is an adsorption complex or a solid solution containing copper, lime, and sulphate, the copper of which is soluble in water to an extent which varies with its composition. It is further believed that the appearance of small amounts of soluble copper in the Bordeaux mixture deposits may be a factor in connexion with foliage injury, and also in the fungicidal action of the spray by supplementing the solvent action of spore excretions previously reported [loc. cit.].

McCallan (S. E. A.) & Wilcoxon (F.). **Laboratory comparison of copper fungicides.**—*Contr. Boyce Thompson Inst.*, ix, 3, pp. 249–263, 4 graphs, 1938.

This is a summarized account of laboratory comparisons, by methods described in previous communications [see preceding abstract *et passim*], of the toxicity, adherence, and injurious action on host foliage of 4–4–50 Bordeaux mixture and nine other representative copper compounds manufactured in the United States [a list of which is appended], in which the evaluations were based on equal copper concentrations in the sprays tested. Details are also given of a method for calculating the Ld 50 (concentration permitting 50 per cent. of the spores to germinate) and its standard deviation from the toxicity curves of compounds tested in the laboratory. In the toxicity tests spore suspensions (adjusted to contain approximately 45,000 to 65,000 spores per c.c.) of *Sclerotinia fructicola*, *Botrytis cinerea*, *Alternaria solani*, *Glomerella cingulata*, *Uromyces caryophyllinus*, or *Gymnoconia peckiana* were pipetted on to glass slides covered with a dried film of the spray tested, both before and after the slides had been exposed for one minute to laboratory 'rain', regulated to give from 0·5 to 0·6 in. of rainfall in this period. Taken as a whole, the results showed that the compounds may be grouped in three classes, with Bordeaux mixture alone in the first; in every case (except *G. peckiana*) this mixture was from 4 to 20 times more toxic than the next best compounds, and 180 to 1,800 times more toxic than the least effective. The third class, low in toxicity, consists of copper phosphate and basic copper sulphate, and the remaining preparations fall into an intermediate class, in which Oxo Bordeaux and coposil are probably the most and copper zeolite the least toxic. Adherence tests based on chemical analyses and toxicity before and after exposure to laboratory 'rain' showed that Bordeaux mixture, cuprocide, and copper oxychloride were the most adherent, and copper oxalate and basic copper sulphate the least. The results of limited greenhouse tests on lettuce, buckwheat, bush beans (*Phaseolus vulgaris*), and maize, and in the open on peach and apple indicated that in general the compounds most toxic to the spores were also the most toxic to the leaves. The difference in injury to the foliage was not, however, as great as that in the fungicidal properties, and all the compounds tested in the open caused injury to some extent. Copper

zeolite, copper-hydro '40', copper phosphate, and copper oxalate produced less injury than Bordeaux mixture, whereas the remainder equalled or surpassed it in toxicity to the leaves.

From these results, and from a survey of the relevant recent literature [most of which has been noticed in this *Review*], the authors conclude that fifty years of experimentation with copper compounds have given none equal to Bordeaux mixture in fungicidal value. In special cases, however, such as lime-sensitive plants, certain other compounds, with lower phytocidal properties, may be more desirable than Bordeaux mixture.

GOLDSWORTHY (M. C.) & GREEN (E. L.). **Effect of low concentrations of copper on germination and growth of conidia of Sclerotinia fructicola and Glomerella cingulata.**—*J. agric. Res.*, lvi, 7, pp. 489–505, 1 diag., 1938.

In this study the authors demonstrated the effect of low concentrations of copper ions on the activity of the conidia of *Sclerotinia fructicola* and *Glomerella cingulata* [*R.A.M.*, xv, pp. 595, 733] in two different ways. By the first method the conidia, embedded in water agar, were placed for 24 hours in an apparatus in which the concentration of copper ions was kept practically constant by means of a controlled gravity flow of the solutions. This 'dynamic' system is believed to resemble more or less the natural condition of a conidium suspended in a drop of rain-water on the deposit from a copper-containing spray, any copper absorbed by the conidium being replaced from the deposit. By the second method the conidia embedded in water agar were exposed to certain concentrations of copper ions added to water, Czapek's, and potato agars, and in this static system the copper concentration was gradually decreased. It was found that the degree of toxicity of ionic copper was higher in the dynamic system, where the conidia of both species were definitely injured by concentrations of ionic copper as low as 0·25 p.p.m., than in the static system, where it varied with the power of the various media to fix, and consequently to inactivate, the copper ions; the amount of fixation appeared to be greatly influenced by direct adsorption or by combination with alcohol hydroxyl groups. The results obtained from the saturated solutions of various copper compounds indicate that although their solubilities appear to be positively correlated with injury when in contact with the tender parts of sprayed plants, yet it is the amount of available rather than of soluble copper which determines the degree of toxicity to the conidia. Thus basic copper sulphate, with a solubility of 11·5 p.p.m., was more toxic than a saturated solution of copper malate, with a solubility of 1,240 p.p.m., the available copper in the former being apparently greater than in the latter. The saturated solutions of cupric oxide (black), copper phosphate, copper zeolite, copper ammonium silicate, and copper silicate were non-toxic to the conidia of both species and it appears that none of the determined solubilities indicates the true availability of the copper in these solutions. One of two copper oxychlorides, despite its relatively high solubility, was only slightly toxic to the conidia of *S. fructicola* and non-toxic to the conidia of *G. cingulata*. The saturated solutions of cuprous oxide (red), basic copper sulphate, one of the

copper oxychlorides, copper maleate, and basic copper maleate were toxic to both species. A saturated solution of copper oxalate was only slightly toxic to *S. fructicola* and innocuous to *G. cingulata* and experiments with diluted concentrations of oxalic acid revealed that this difference was due to the specificity of the acid. The addition of an equivalent amount of malic acid entirely inactivated quantities of ionic copper known to be lethal to the conidia of *S. fructicola* since it appears that the copper malate molecule is not absorbed by the latter. Low concentrations of this acid were assimilated by the conidia of both species, and promoted growth.

The author concludes that the injurious effects of a copper compound on sprayed plants may be determined by its solubility and the fungicidal activities by the degree of ionization in its solution. Most of the materials that are more or less injurious to higher plants appear to have solubilities of the same order as those of alkaline Bordeaux mixtures and few of these are likely to be less injurious than the latter. An ideal copper spray would be one in which the copper ion concentration is high enough to be toxic to fungus spores but not to be seriously phytocidal; this concentration appears to be about 1·0 p.p.m.

Fajans (E.) & Martin (H.). **The incorporation of direct with protective insecticides and fungicides. III. Factors affecting the retention and spray residue of emulsions and combined emulsion-suspensions.**—*J. Pomol.*, xvi, 1, pp. 14–38, 1 pl., 2 graphs, 1938.

Continuing their previous studies [*R.A.M.*, xvi, p. 694], the authors give a fully tabulated account of laboratory and field experiments made to ascertain the physico-chemical properties which determine retentiveness and tenacity of the deposit in sprays consisting of penetrant emulsions (liquid/liquid systems) and of added suspensions (liquid/liquid/solid systems).

Bary (P.) & Cornu (C.). **Sur un nouveau mode de préparation des solutions colloïdales employées contre les parasites des plantes.** [On a new mode of preparation of the colloidal solutions used against plant parasites.]—*C.R. Acad. Agric. Fr.*, xxiv, 7, pp. 304–307, 1938.

Directions are given for a simple method of preparing colloidal solutions of standard fungicides for immediate use. The total quantity of liquid required is equally divided in two vessels, which are so placed that their contents flow straight into the hose of the spraying apparatus where the two solutions, e.g., of copper sulphate and sodium carbonate, mix and are immediately projected on to the leaves and fruits to be treated. The spray is free from aggregations of insoluble matter, and is evenly dispersed over the plant surface in the form of a light deposit.

Jamalainen (E. A.). **Kasvinsuojeluaineiden tarkastus Tanskassa ja Saksassa.** [The testing of plant protectives in Denmark and Germany.]—*Valt. Maatalousk. Julk.*, 97, 32 pp., 2 figs., 1938. [German summary.]

With a view to the introduction into Finland of an official system of testing plant protectives, the writer investigated the organization of

this branch of phytopathology in Denmark [*R.A.M.*, xvii, p. 332] and Germany [ibid., xvii, p. 51] in 1937 and here summarizes the results of his observations, on the basis of which he concludes that the methods employed in either of these countries might equally well serve as a model for a Finnish service on similar lines.

YOUNG (E. L.). **Labyrinthula on Pacific Coast Eel-Grass.**—*Canad. J. Res.*, Sect. C, xvi, 3, pp. 115–117, 1938.

Zostera marina collected off the coast of British Columbia in September, 1936, and July, 1937, was found to be infected with a *Labyrinthula* [*R.A.M.*, xvi, p. 698] apparently identical with the organism found on the grass in Atlantic waters and identified by the author as *L. macrocystis* Cienkowski. The macroscopic and histological appearance of the infected grass also appeared to be identical with the condition of the affected Atlantic grass.

LOCKWOOD (L. B.) & MOYER (A. J.). **The production of chemicals by filamentous fungi.**—*Bot. Rev.*, iv, 3, pp. 140–164, 1938.

In this survey the authors, after a brief introductory discussion of industrial processes utilizing moulds, give a short description of the three basic types of apparatus used in industrial fermentation, viz., shallow pans, deep vats, and rotating drums, indicate the procedure generally adopted, and then discuss a number of products obtained from fungi. A bibliography of 173 titles is appended.

BLATTNÝ [C.]. **Poznámka o méně známých virových chorobách.** [Note on some less known virus diseases.]—*Ochr. Rost.*, xiv, 55, pp. 86–87, 1938. [German summary on p. 99.]

This is a very briefly annotated list of relatively little known virus diseases of various plants stated to have been observed in Czechoslovakia, namely: vein mosaic of the dog rose (*Rosa canina*), small-leaved birches, and aspen; interveinal mosaic of birch; and mottled mosaic of the elm and horse chestnut. Ring spot mosaic of plums is not frequent, but it was found to be sometimes latent in myrobalan [*Prunus divaricata*] stocks, the symptoms later developing in the plums grafted on them. Hops are attacked by streak and ring spot mosaics, the first of which is transmissible both by sap and by grafts, but usually only occurs on very old hop plants, and the second, only transmissible by sap, is of a transient nature and does not apparently affect the yield. Cultivated iris plants not infrequently exhibit symptoms resembling 'breaking' in tulips [*R.A.M.*, xvii, p. 459], associated with defective or belated development of the flowers.

STANLEY (W. M.). **The biophysics and biochemistry of viruses.**—*J. appl. Phys.* (formerly *Physics*), ix, 3, pp. 148–155, 2 figs., 1938.

Among the items of phytopathological interest in this critical survey of the biophysical and biochemical aspects of viruses, already largely covered by earlier notices in this *Review*, the following may be mentioned. The sedimentation constants of the heavy proteins isolated by Wyckoff by differential ultracentrifugation from Turkish tobacco plants infected by the latent mosaic of potato, tobacco ring spot, severe etch,

and cucumber mosaic viruses were found to be 113, 110, 180, and 120, respectively. These heavy proteins were found to possess the properties of their respective viruses. Whereas normal tobacco plants contain no demonstrable heavy protein, the virus protein content of those suffering from mosaic is estimated at 400 mg. per 200 gm. plant tissue, or about one part of protein per 500 parts of tissue. Loring has found, however, that virus-diseased tomato and spinach plants contain, respectively, only 260 and 30 mg. These disparities may possibly be significant as indicating that the level reached by the virus protein in different plants depends on a characteristic individual mechanism. The amount of virus protein in a given host also varies with the particular strain of the virus, that of aucuba mosaic in tobacco amounting to only 350 and the masked strain to 200 mg. as compared with 400 for ordinary mosaic.

The density of the tobacco mosaic virus protein has been shown by fractional crystallization to be 1·33, or substantially higher than the value (1·1) usually quoted for bacteria. The viscosity of tobacco mosaic virus protein solutions has been found to lie between that of gelatine and egg albumin, and is thus considerably less than that of myosin. The molecules of the protein are probably not thread-like, but are of the order of, say, ten times as long as their cross-section.

STANLEY (W. M.). **The reproduction of virus proteins.**—*Amer. Nat.*, lxxii, 739, pp. 110–123, 1 fig., 1938.

In this address, read at a symposium of the American Society of Naturalists, December, 1937, the author discusses certain aspects of virus studies in relation to the nature of protoplasm and arrives at the conclusion that, although the physical and chemical properties of tobacco mosaic virus protein seem to indicate that it is a molecule [*R.A.M.*, xvii, p. 407 and preceding abstract], it has, in addition to the ordinary properties of molecules, the ability to reproduce and to mutate and that therefore it represents an entity hitherto unknown. Assuming that the virus protein may be built up from smaller serologically inactive units and that the living cell contains all the component parts, the author suggests, as a matter of speculation, that the virus protein molecule introduced into a living cell may be able to cause these component parts to line up in an orderly fashion according to the pattern of the virus protein, in a similar way as a crystal causes the crystallization of substances when introduced into a saturated solution.

ALLINGTON (W. B.). **The separation of plant viruses by chemical inactivation.**—*Science*, N.S., lxxxvii, 2255, p. 263, 1938.

The author accomplished the separation of mixed viruses of cucumber mosaic and potato ring spot by adding potassium permanganate at concentrations varying from 0·1 to 0·9 per cent. to the mixtures, when (except in one experiment) only the potato ring spot virus survived. Lithium carbonate (1 per cent.) and copper sulphate (2 per cent.) gave similar results. By treatment of the mixed viruses with silver nitrate (0·1 to 0·5 per cent.) or mercuric chloride (0·1 to 0·9 per cent.), the potato ring spot virus was inactivated leaving only the cucumber mosaic virus infective. The chemicals were added to the virus extracts

and allowed to act at 20° C. for one hour. After diluting these preparations to 1 in 50, inoculations were made on Havana tobacco, and if symptoms caused by only one virus were apparent, extracts from such plants were tested for purity by further inoculations into tobacco.

RAWLINS (T. E.) & TAKAHASHI (W. N.). **The nature of viruses.**—*Science*, N.S., lxxxvii, 2255, pp. 255–256, 1938.

The authors discuss the recent experimental results obtained by various workers which appear to be evidence for the animate nature of viruses. Comparing the reports by F. Miescher (1896), W. J. Schmidt (1928), and F. Rinne (*Trans. Faraday Soc.*, xxix, p. 1016, 1933), stating that a large proportion of the material in the heads of certain sperms is a doubly refractive nucleoprotein, and that the X-ray analysis of these sperms indicates that this material is in a liquid crystalline state, with the reports by other workers stating that the purified tobacco mosaic virus protein shows double refraction and the same X-ray pattern, the present authors conclude that the tobacco mosaic virus may possibly be a submicroscopic, elongated organism composed largely or entirely of liquid crystalline nucleoprotein and that the double refraction is produced by the tendency of this organism to become orientated by streaming or standing. Referring to the bacterium-shaped virus particles photographed by J. E. Barnard by the use of ultra-violet light [*R.A.M.*, iv, p. 687], the authors state that these, like tobacco mosaic virus nucleoprotein and the nucleoprotein in chromosomes, have been reported to show high absorption of wave-lengths in the neighbourhood of 2,570 Å, and they suggest that all three materials may possibly have a somewhat similar composition. Furthermore, Bawden and Pirie [see below, p. 564] have shown that tobacco mosaic is not appreciably hydrolysed by proteolytic enzymes until the virus is inactivated by heating, and this behaviour toward enzymes is similar to that shown by organisms.

FRANKE (H. M.). **Zur Physiologie der pflanzlichen Virose.** [On the physiology of the plant viruses.]—*Biochem. Z.*, ccxcvi, 1–2, pp. 149–152, 1938.

G. A. Kausche's recent report of his studies on the X and Y viruses of potato [*R.A.M.*, xvii, p. 265] contained various criticisms of the analytical methods used by the writer in his investigations on tobacco mosaic [ibid., xvii, p. 129]. The objections are briefly discussed and explanations given for the particular technique employed, especially with reference to the acid titration of the expressed juice. Extreme caution is indicated in the comparative interpretation of the analytical data secured in the study of such widely divergent virus groups as those represented on the one hand by tobacco mosaic, and on the other by the X and Y viruses of potato.

VERGE (J.). **Les ultra-virus.** [The ultra-viruses.]—*Rec. Méd. vét.*, cxiii, 11, pp. 653–679, 1937.

This is a critical, thoroughly documented study of the ultramicroscopic virus diseases of man, animals, and plants, comprising sections on the history of the viruses; their nomenclature and hosts; physical,

chemical, biological, and physiological properties; saprophytic ultramicroscopic viruses; classification; and origin and nature of ultramicroscopic viruses.

VIERHAPPER (F.). **Neuere Ergebnisse chemischer Virusforschung.** [Recent results of chemical virus research.]—*Öst. ChemZtg*, xli, 6, pp. 118–123, 2 figs., 1938.

This is a critical discussion of some outstanding recent contributions to the chemistry of plant and animal viruses, most of which have been noticed from time to time in this *Review*.

THORNBERRY (H. H.). **Pectase activity of certain micro-organisms.**—*Phytopathology*, xxviii, 3, pp. 202–205, 1938.

According to Neuberg and Ostendorf (*Biochem. Z.*, ccxxix, p. 464, 1930), extracts from pectase-active plant tissues hydrolyse the ester linkage of the half calcium salt of monomethyl tartaric acid. The ester being water-soluble and hydrolysable by pectase into soluble methyl alcohol and insoluble half calcium salt of tartaric acid, this method of determining pectase activity offers promise of utility for quantitative measurements based upon the precipitate formed. The present paper deals with the data obtained at the Kentucky Agricultural Experiment Station from the determination by this method of the pectase activity of certain plant pathogens [*R.A.M.*, vii, p. 192; xiii, p. 530] and of an extract of cured tobacco leaves.

The organisms, comprising eight strains of *Fusarium* sp. from tobacco stems, two of *Sclerotium bataticola* [*Macrophomina phaseoli*: ibid., xvii, p. 115], *Sclerotinia sclerotiorum*, *S. trifoliorum* [ibid., xvii, p. 235], *Rhizoctonia* sp. from tobacco, three strains of *Thielaviopsis basicola* [see below, p. 560], *Phytomonas* [*Bacterium*] *mori* [*R.A.M.*, xvi, p. 785], *P. tabaca* [*Bact. tabacum*], and *P. angulata* [*Bact. angulatum*: ibid., xvii, p. 353], were grown for five days at 37° C. in 100 ml. nutrient broth containing 10 per cent. commercial pectin, adjusted to a reaction of P_H 8·5 in 0·1 molar phosphate buffer, and passed through filter-paper. The mycelial mass of fungal pathogens in the residue and 25 gm. of cured tobacco leaves were macerated separately and extracted in 100 ml. molar phosphate buffer at P_H 8·5 for six hours at room temperature. The enzymes in the filtrates from these extractions and the filtrate from the culture fluids were precipitated by alcohol and the dried precipitate was extracted in 2 ml. 0·1 molar phosphate buffer at P_H 8·5, and filtered, the clear filtrate being used immediately as the preparation of pectase. Five ml. of a 10 per cent. aqueous solution of the crude syrup of the ester, adjusted to P_H 6·5 in an acetate buffer, was added to the pectase preparations. On mixing the liquids and adding 0·5 ml. toluol, the solutions were incubated at 37° for 1 to 5 days. A precipitate in the tubes indicated hydrolysis, which is considered to represent pectase activity.

Freshly isolated cultures of *F.* sp. gave moderate hydrolysis, whereas little or no activity was shown by those that had undergone repeated subculturing since removal from their host. *S. sclerotiorum* and *S. trifoliorum* were only slightly active, but considerable hydrolysis took place in the tubes inoculated with *M. phaseoli*. The tobacco *Rhizoctonia* gave negative results, while those obtained with *T. basicola* were variable.

In inoculation tests on tobacco with a culture of the latter fungus showing fair pectase activity, E. M. Johnson (unpublished data) induced severe black root rot, whereas another less active culture caused milder symptoms. Cured tobacco-leaf extracts possessed a fair amount of activity.

MURPHY (P. A.). **The leaf roll disease of Potatoes: a summary of modern knowledge.**—*J. Dep. Agric., Eire*, xxxv, 1, pp. 1–19, 4 pl., 1 fig., 1938.

In this paper the author gives a full review of the information at present available on potato leaf roll [*R.A.M.*, xvii, p. 479], with special reference to conditions in Eire.

DAVIDSON (W. D.). **Rainfall and seed Potatoes.**—*J. Dep. Agric., Eire*, xxxv, 1, pp. 20–24, 1938.

In this paper the author adduces reasons in support of the view that the best localities in Eire for growing seed potatoes are those with a cool, moist climate and a high rainfall well distributed throughout the growing season. During the three abnormally dry summer seasons of 1932 to 1934 there was an unusual spread of leaf roll [see preceding abstract] with a corresponding loss of vigour in areas on the east coast having a low rainfall, though in the much wetter parts in the west, south-west, and north-west the disease was very rare. In recent years it has been easier to keep stocks vigorous and free from leaf roll in County Cork, where the rainfall is comparatively high, than in Louth, where it is much lower, and the atmosphere is drier and colder. The superiority of mountain seed is probably due to the heavier rainfall on the higher ground.

The test of the suitability of a district for potato seed production is its capacity to preserve the vigour of stocks for very long periods without a change of seed.

The Pink Eyes variety has been grown in Galway since 1795; the Lumper, grown since 1808 in the Dingle peninsula, Kerry, was still found there in 1930; the White Rick variety has been grown in Donegal since before 1840; and Early Rose on the Athlone bog lands since 1867. In none of these cases has there been a change of seed within living memory. Soils (if not waterlogged) which retain a considerable amount of water appear to be superior for seed potato-growing to light, sandy soils. Vigour cannot be due to coldness, as the mild west coast of Eire produces better potato seed than the colder east coast. Investigations by Maldwyn Davies in Wales have shown that *Myzus persicae* is very inactive under moist or windy conditions, and very active in calm, sunny weather, and this explains the retention of vigour by potatoes in regions of high rainfall.

FRIEDRICH (H.). **Uber die Spaltöffnungsweiten blattrollkranker Kartoffelpflanzen. Untersuchungen mit der Infiltrationsmethode.** [On the width of the stomatal apertures in Potato plants affected with leaf roll. Investigations by the infiltration method.]—*Angew. Bot.*, xx, 2, pp. 129–155, 1 fig., 5 diags., 1938.

The author points out that, in spite of certain improvements

introduced by him into the infiltration method of measuring the width of the stomatal aperture, the results obtained are admittedly open to criticism on account of errors inseparable from the method, but nevertheless he regards them as in all probability correct, especially as they agree with those obtained by other workers using different methods. In the course of field experiments leaflets picked from 18 different potato varieties, both healthy and affected with leaf roll [*R.A.M.*, xvii, p. 338 and preceding abstracts], were dipped in xylol, turpentine, turpentine plus castor oil, or alcohol, withdrawn at once and carefully examined, any degree of penetration of the liquid into the leaf being recorded as infiltration. Care must be taken to carry out the whole range of experiments under uniform weather conditions and if possible in full sunshine, since all the 18 varieties exhibited practically the same degree of infiltration under uniform conditions but showed increased infiltration at high moisture contents of soil and air. The results of 25 experiments involving the testing of 750 leaves showed that in the case of healthy plants xylol invaded 87 per cent. of the leaflets, turpentine 83 per cent., turpentine + castor oil 67 per cent., and alcohol 43 per cent., the corresponding percentages for diseased plants being 50, 50, 33, and 20. It is believed, therefore, that the stomatal apertures of leaf roll diseased plants are more nearly closed than those of healthy plants. This may be explained, on the basis of Stålfelt's hypothesis (*Planta*, viii, p. 287, 1929), by the increased turgor of the cells of the epidermis due to the increased production of starch and glucose in the diseased leaf.

GIGANTE (R.). **Esperienze sulla trasmissibilità della 'necrosi del cuore' dei tuberi di Patata.** [Experiments on the transmissibility of 'heart necrosis' of Potato tubers.]—*Boll. Staz. Pat. veg. Roma,* N.S., xvii, 3, pp. 277–292, 4 figs., 1937 [issued March, 1938].

Further investigations carried out in Italy into potato heart necrosis [*R.A.M.*, xv, p. 458; xvii, p. 410] showed that the disease is transmitted from diseased plants to the next generation by both affected and apparently sound tubers. Continued reproduction of diseased tubers aggravates the disease and greatly reduces the yield. No transmission occurs when healthy potato plants are inoculated with juice from, or grafted with, parts from plants grown from diseased tubers. Tomato, chilli, eggplant, and tobacco plants similarly treated also remained unaffected. When healthy tubers of Böhm's Allerfrüheste Gelbe, Noordeling, and Paul Krüger [President] potatoes were inoculated with pieces from diseased tubers of Böhm's variety, the only variety to become affected was President, which showed 2 per cent. infection. When healthy Böhm's tubers were inoculated with juice from affected and apparently healthy tubers of the same variety, 3 per cent. and 2 per cent., respectively, of the daughter tubers became affected. It is concluded that the disease is due to a virus and is in some respects analogous to 'Eisenfleckigkeit' [loc. cit.].

SCOTT (R. J.). **Mosaic diseases of the Potato.**—*Scot. J. Agric.*, xxi, 2, pp. 121–132, 1938.

Recent improvements in the potato scheme of the Department of Agriculture for Scotland include the inspection of all stocks for health

as well as for purity, there being over 50,000 acres inspected annually. The certificates awarded in 1937 were as follows: (1) Stock Seed to crops which were 99·95 per cent. pure and practically healthy apart from negligible mottle; (2) T.S. (A.) (immune varieties) and N.I. (A) (non-immune varieties) to crops which were 99·5 per cent. pure and contained not more than 1 per cent. total of mild mosaic, severe mosaic, leaf roll, and wildings; (3) T.S. (H) and N.I. (H.) to crops which were 99·5 per cent. pure and contained not more than 3 per cent. of severe mosaic, leaf roll, and wildings. B reports were issued for crops which were 97 per cent. pure and contained not more than 3 per cent. of severe mosaic, leaf roll, and wildings. For instructional purposes five arbitrary grades of mosaic have been recognized, (1) negligible mottle, which can only be seen by careful examination and is possibly not even visible in sunshine; (2) borderline mild mosaic, which is an overlapping of the negligible mottle and mild mosaic; (3) mild mosaic showing mottling visible at a distance of two to three paces and not obscured in sunshine but causing no reduction in size of plant or distortion of leaf surface; (4) borderline severe mosaic showing very obvious mottling and possibly slight distortion of leaf and very slight reduction in size of plant; (5) severe mosaic causing substantial reduction in size of plant and distinct distortion and mottling of leaf. In the actual inspection scheme these grades are condensed into three, the two borderline sections being dispensed with.

The author gives a tabulated analysis of viruses and virus combinations present in each grade of disease, much of which has already been noticed [*R.A.M.*, xvii, p. 374]. Potato varieties can be classified according to virus content into three classes: (*a*) virus-free varieties, e.g., Majestic, (*b*) varieties invariably infected with virus X, e.g., Up-to-Date, and (*c*) varieties invariably infected with virus A, e.g., Golden Wonder, and it is suggested that the breakdown of healthy stocks would be avoided by growing varieties of one class only; but as this is impracticable, growers are advised to grow varieties from different classes widely separated by a minimum distance of 50 yds., and those of the same class with sufficient isolation to avoid mixing. Virus Y is not considered in the scheme, since it is comparatively rare in Scotland and probably already entirely eradicated by growers, who have been growing crops of stock seed standard for a number of years.

Köhler (E.). **'Mutationen' bei pflanzenpathogenen Viren. (Sammelreferat.)** ['Mutations' in plant-pathogenic viruses. (A symposium.)] —*Züchter*, x, 3, pp. 68–72, 1 fig., 1938.

All the work on which the writer bases his concise survey of the phenomenon of mutation in some well-known plant-pathogenic viruses has been noticed from time to time in this *Review*.

Starý (B.). **Elektrometrické hodnocení sadbové hodnoty Bramborových hliz pomocí redoxpotenciálu.** [Electrometrical determination of the seed value of Potato tubers by means of the reduction-oxidation potential.]—*Ochr. Rost.*, xiv, 55, pp. 53–55, 1938. [German summary.]

In giving a brief account of experiments conducted to check

Wartenberg and Hey's electrometric method [*R.A.M.*, xvii, p. 341] of determining the freedom or otherwise of potato seed tubers from virus diseases, the author states that departing from the German method he compared the positive, as against the negative, values of the reduction-oxidation potential in healthy and in diseased tubers, one-half of which was used for the tests and the other was planted for control purposes. The results of tests with several potato varieties showed that in the pulped tissues of diseased tubers the potential varied between 200 and 520 millivolts, and that in those of healthy tubers it varied between 100 and 350 millivolts, i.e., that the lower the potential the higher is the seed value of the tubers. A weak point of the method is the overlapping to the fluctuation limits, which, taken together with the delicate nature of the tests, tends to limit its usefulness for the determination of the health of seed tubers.

STRAŇÁK [F.], BLATTNÝ [C.], STARÝ [B.], NOVÁK, ROBEK, & NOLČ. **Poznámky k methodě Glynne-Lemmerzahlově o zjišťováni náchylnosti odrůd Bramborů vůči rakovině.** [Observations on the Glynne-Lemmerzahl method for the determination of the susceptibility of Potato varieties to wart disease.]—*Ochr. Rost.*, xiv, 55, pp. 91–94, 1 fig., 1938. [German summary on p. 101.]

The authors state that in 1937 they tested over 800 potato varieties and hybrid seedlings for wart disease (*Synchytrium endobioticum*) both in the laboratory by the Glynne-Lemmerzahl method [*R.A.M.*, x, p. 403; xv, p. 524] and in the field, the results showing up to 95 per cent. agreement in the two parallel series. The laboratory method, however, is much more severe than the field tests and is particularly useful in eliminating susceptible hybrid seedlings, but for practical purposes maintained field resistance is sufficient, even when the other method does give indications of slight susceptibility. The formation on the potato organs of abortive infections is not, as held by certain investigators [loc. cit.], an indication of wart disease resistance, since it also occurs in very susceptible seedling varieties. It is further stated that certain English and German potato varieties, described as immune, and many wild potato species gave indications of susceptibility in laboratory tests.

GRÜNFELD (O.). **Ein Jahrfünft Kartoffelkrebsversuche der Liebwerder Station für Pflanzenschutz in Schluckenau. (Eine vorläufige Übersicht aus der Station für Pflanzenschutz.)** [Five years' Potato wart disease tests at the Liebwerd Plant Protection Station in Schluckenau. (A preliminary review by the Plant Protection Station.)]—*Ochr. Rost.*, xiv, 55, pp. 70–74, 1938. [Czech summary.]

After describing the procedure adopted in potato tests for resistance to wart disease [*Synchytrium endobioticum*] at the Tetschen-Liebwerd Plant Protection Station near Prague, the author gives a preliminary list of potato varieties which in experiments from 1933 to 1937 have been found to be completely immune from the disease both in the laboratory and in the field, namely: Modrow's Aal and Blaupunkt; Böhm's Ackersegen, Mittelfrühe, Ovale, and Ovalgelbe; Veenhuizen's Alberta; P.S.G.'s Cellini, Flava, Fram, and Tiefgelbe Rote; Paulsen's Estimata

and Juli; Zwehl's Feldglück and Feldsonne; Müller's Fredanna; Ebsdorfer's Juli; Kameke's Parnassia and Robinia; Deutschbroder's Nieren and Viktoria; Lembke's Edda; Alpha, Altgold, Betula, Edelragis, Ragis, Frieso, Frühgold, Furore, Goldball, Goldfink, Goldwährung, Havilla, Hellena, Ideal, Integra, Isolde, Maibutter, Mela, Kerkauer Nieren, Nordost Stärkereiche, Nordost Goldgelbe, Ostbote, Parnassia Valečovská, Parnassia Kerkovska, Kerr's Pink, Preussen, Quitte, Sazavky, Sickingen, Treff As, Vera, and Voran. Paulsen's Roland needs further testing, as a few tubers showed traces of infection in the laboratory.

Verzeichnis der krebsfesten Kartoffelsorten im Sinne der Verordnung zur Bekämpfung des Kartoffelkrebses vom 8 Oktober 1937. [List of wart-immune Potato varieties in the sense of the Order for Potato wart control of 8th October, 1937.]—*NachrBl. dtsch. PflSchDienst*, xviii, 3, p. 21, 1938.

In pursuance of an Order of 8th October, 1937, aiming at the gradual elimination of potato wart [*Synchytrium endobioticum*] from the German Reich [cf. *R.A.M.*, xvii, p. 208], lists are given of 40 varieties admitted to unrestricted cultivation, 26 of which may be grown conditionally, 5 allowed to be cultivated for seed certification for the last time in 1938, and 93 no longer to be placed on the market for seed purposes.

Sukhorukoff (I.), Kling (E.), & Ovčarov [Ovtcharoff] (K.). **The effects of Phytophthora infestans de Bary on the ferments of affected plants.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xviii, 8, pp. 597–602, 1938.

Referring to Lepik's work [*R.A.M.*, viii, p. 596], the results of which appear to indicate that *Phytophthora infestans* is able to use the starch in potato tubers infected by it, the authors state that in their own aseptically conducted experiments the fungus consistently failed to grow in media containing starch as the source of carbon in the absence of extraneous diastase, and that its mycelium was shown by biochemical tests not to contain amylase. They further refer to investigations in 1923 by Haehn and Schweigart, who found that the activity of amylase in potato tubers is very low, a fact which was confirmed by them. The authors claim to have established by special tests [some details of which are given] that potato foliage and tubers contain a substance inhibiting amylolytic reactions, which they tentatively identify with sistoamylase, described in 1933 by Chrzaszcz and Janicki [Janitzki] as existing in the seeds and shoots of buckwheat and cereals. Further determinations showed that the amount of sistoamylase is considerably greater in varieties (*Solanum demissum* and 8670 JKH) immune from or highly resistant to *P. infestans* than in Early Rose, which is very susceptible; the quantity is not constant, however, in potato tubers, but undergoes noticeable changes during the resting period. In yet another series of experiments it was found that in developing on potato (Lorch) tubers the fungus gradually reduced their content of sistoamylase, a peculiarity which is believed to play a prominent part in its biology and in its pathogenicity to the potato. By lowering the content of the potato plant in sistoamylase, which is stated to hinder the development of other micro-organisms, it renders the potato tubers accessible to secondary putrefactive organisms.

LEHMANN (H.). **Geschichte und Ergebnisse der Versuche zur Züchtung krautfäulewiderstandsfähiger Kartoffeln.** [History and results of experiments in the breeding of late blight-resistant Potatoes.]—*Züchter*, x, 3, pp. 72–80, 1938.

The writer outlines the history of potato-breeding for resistance to late blight (*Phytophthora infestans*) and summarizes the results of some outstanding contributions towards the solution of the problem, most of which have been noticed from time to time in this *Review*.

NATTRASS (R. M.). **Note on two diseases of Potato tubers.**—*Cyprus agric. J.*, xxxiii, 1, pp. 4–6, 4 figs., 1938.

Potatoes in Cyprus have recently become infected by *Alternaria solani* [*R.A.M.*, xvi, p. 20] and *Macrophomina phaseoli* [ibid., xi, p. 126]. The presence of either disease leads to the rejection by the official inspection service of potatoes consigned for export. Control of *A. solani* consists in spraying in the early stages of foliage infection with Bordeaux mixture or other protective copper fungicide. *M. phaseoli* produces circular or oval black spots, 2 to 3 mm. in diameter, the centre of each being raised, lighter in colour than the surrounding tissue, and showing broken skin. The outline of the smaller spots is distinct, while that of the larger ones is diffuse. When close enough together the spots form a larger lesion of indefinite outline. The diseased tissue extends to a depth of about 2 mm. only. In the larger spots there is an air space between the skin and the top of the diseased tissue which becomes black and dry, the flesh of the tuber after cutting also quickly turning black; such tubers rapidly rot in storage. The fungus appears to enter the tubers through the lenticels. It is a common soil-inhabiting organism in Cyprus, and is spread by tools and irrigation water. All affected plants, potatoes and others, should be uprooted and destroyed.

ORTON (C. R.) & HILL (L. M.). **Further observations on 'blue stem' of Potato.**—*Amer. Potato J.*, xv, 3, pp. 72–77, 1 fig., 1 diag., 1938.

Further observations and experiments in connexion with the widely distributed disease of potatoes, referred to as 'blue stem' in West Virginia [*R.A.M.*, xvi, p. 831] and Pennsylvania, clearly point to the probable association of the trouble with insect infestation; the implication of bacteria or fungi would appear to be definitely excluded by the negative results of extensive isolation and inoculation experiments.

FUKUSHI (T.). **An insect vector of the dwarf disease of Rice plant.**—*Proc. imp. Acad. Japan*, xiii, 8, pp. 328–331, 1 fig., 1937.

The author's studies during 1936–7 at Horigome confirmed the conclusion reached by Takata, more than 40 years ago, that *Deltocephalus dorsalis* Motsch. was a vector of the dwarf disease of rice [*R.A.M.*, xvi, p. 485]. The symptoms transmitted by its agency were entirely identical with those transmitted by *Nephotettix apicalis* Motsch. var. *cincticeps* Uhl., generally believed in Japan to be the sole vector of the disease. Of 112 leafhoppers tested in 1936, 45 killed the rice plants, and of the remainder only one produced infection on 21 of 25 plants exposed to its feeding for one day. In the series of experiments during 1937 about

40 per cent. of the leafhoppers killed the plants, and 17 insects produced infections. In both years several of the insects produced numerous minute white flecks or stripes along the leaf veins, a symptom resembling that of dwarf disease at an early stage of its development, but confined to the leaves actually affected by the insects, while subsequent new growth remained healthy.

HARRAR (J. G.). **Factors affecting the pathogenicity of Fomes lignosus Klotzsch.**—*Tech. Bull. Minn. agric. Exp. Sta. 123*, 28 pp., 10 figs., 1937.

The taxonomy of the fungus causing root rot of *Hevea brasiliensis* is not yet finally settled, but the author uses the name *Fomes lignosus* [*R.A.M.*, xvii, p. 484] since it appears to be the most commonly used in recent literature. Cultures from rotted *Hevea* roots from the Firestone rubber plantations in Liberia were used in the present study. The formation of rhizomorphic strands was observed in soil cultures in which nutrient media were incorporated. The hyphae are hyaline, vary from 1·8 to 6·2 μ in diameter, and are characterized by anastomoses and numerous large clamp-connexions. Both bi- and multinucleate cells were present. True spores were not found to develop in culture, but frequently chlamydospore-like organs were formed. The hyphae often possessed long, pointed tips with a subterminal swelling producing spore-like structures which are believed to be resistant to desiccation and other unfavourable conditions. Temperature tests showed that the cultures of the fungus could not live above 36° C. or below 2°, the optimum temperature for growth being about 28°. At the optimum temperature on different media the fungus grew at P_H values from 4 to over 10, the optimum varying according to the medium from P_H 6 to 7·5. Light conditions had little effect on the growth of the fungus in culture, but direct sunlight at 80° F. or excessive ultra-violet light rapidly killed the culture. Fertilizers appeared to have no appreciable effect on the development of the fungus in soil. Of 13 fungicides tested the organic mercury dusts were found to be the most toxic, new improved ceresan at a concentration of 0·001 per cent. being the best.

KALIS (K. P.). **Beknopt overzicht van de Rubber- en Theecultuur in het rayon Bandjar-Tasikmala-Garoet.** [An abridged survey of Rubber and Tea cultivation in Bandjar-Tasikmala-Garoet region.] —*Bergcultures*, xii, 13, pp. 375–380, 1938.

The following items of phytopathological interest occur in this report on *Hevea* rubber and tea cultivation in West Java during 1937. Rubber mildew [*Oidium heveae*: *R.A.M.*, xvii, p. 414] assumed a virulent form, and the outcome of sulphur-dusting experiments was inconclusive and frequently disappointing, especially in respect of the preservation of the fruit for seed. Mouldy rot [*Ceratostomella fimbriata*] was also prevalent.

A correlation was observed between red root rot of tea [*Ganoderma pseudoferreum*: ibid., xvii, p. 202] and the common local practice of felling the *Albizzia* trees, interplanted for shade or manure, at ground-level, which permits the spread of the fungus through the plantation by way of the infected stumps. A high incidence of black root rot [*Rosellinia arcuata* and *R. bunodes*] [loc. cit.], which is commonly observed on late

volcanic soils, was frequently, but not invariably, found to be associated with the presence of dying lamtoro [*Leucaena glauca*].

STARKEY (R. L.). **Some influences of the development of higher plants upon the microorganisms in the soil: VI. Microscopic examination of the rhizosphere.**—*Soil Sci.*, xlv, 3, pp. 207–248, 11 pl., 1938.

Using Cholodny's buried slide technique [*R.A.M.*, xv, p. 334], the writer pursued his investigations in New Jersey, now extending over a considerable period, on the influence of higher plants [represented by eight crop plants] on the micro-organisms of the soil, with particular reference to the rhizosphere. Fungus hyphae were abundant even in fallow soil, and there is no doubt that fungi develop vegetatively even in the absence of appreciable amounts of readily decomposed organic matter. Among the fungi detected were *Fusarium*, (?) *Helminthosporium*, *Alternaria*, *Penicillium*, (?) *Sporotrichum*, and an unidentified organism with spores shaped like six-pointed stars, with a deeply staining central body. The fungal mycelia were observed to be very prone to destruction by bacteria, and their persistence in the soil is not generally of long duration. Very little difference was evident in the response of the micro-organisms to different plants.

MACLACHLAN (J. D.). **A rust of the Pimento tree in Jamaica, B.W.I.**—*Phytopathology*, xxviii, 3, pp. 157–170, 3 figs., 1938.

In this full account of his study on the rust *Puccinia psidii* [*R.A.M.*, xvii, p. 17] attacking pimento (*Pimenta officinalis*) in Jamaica [ibid., xv, p. 742], the author states that *P. psidii* was originally described by Winter (*Hedwigia*, xxiii, p. 164, 1884) on *Psidium pomiferum*, which is regarded as a variety of the common guava, *P. guajava*. The latter has been reported as a host of the rust in Porto Rico, but is apparently immune from the pimento and rose apple (*Eugenia jambos*) strains. The expanding foliage, inflorescences, and succulent young twigs are all attacked, while the new leaves formed to replace the fallen ones in turn become diseased. Under Jamaican conditions the rust is perpetuated by the uredospores; teleutospores were found, but no host for the haploid stage was recognized.

MURPHY (P. A.). **Ireland: first appearance of downy mildew of Hop (Pseudoperonospora humuli).**—*Int. Bull. Pl. Prot.*, xii, 3, pp. 53–54, 1938.

A typical outbreak of downy mildew of hops (*Pseudoperonospora humuli*) occurred on the dried cones of a so-called wild hop in an experimental garden in County Cork, Eire, during the exceptionally wet summer of 1937, this being the first record of the disease for the country. Since the imported plants remained healthy from 1935 to 1937, infection presumably did not originate on this material, but is more likely to have been conveyed from the nearest centre of hop cultivation in England, a distance of some 265 miles.

RHIND (D.), ODELL (F. D.), & SU (U. T.). **Observations on phyllody of Sesamum in Burma.**—*Indian J. agric. Sci.*, vii, 6, pp. 823–840, 3 graphs, 1937. [Received April, 1938.]

Investigations carried out in Burma since 1923 into 'phyllody' or

green flowering disease of sesame [*R.A.M.*, xv, p. 396] failed to demonstrate that the condition is seed-borne, and indicated that if the cause is a virus, it is one not readily transmitted by inoculation. Early sowing gave a high percentage of affected plants, and low rainfall favoured the disease. High susceptibility was associated with white seed coat, unbranched habit, and short life-period. When slightly affected plants produce viable seeds they fail to show a normal onset of dormancy. Affected plants have a higher mineral metabolism than unaffected. In conclusion, the suggestion is made that phyllody may be due to failure of the reproductive phase to progress normally, owing to various environmental factors acting on complex, undetermined genetic groupings, the reproductive tissues returning to the vegetative condition. The possibility that the condition may be due to a virus is not entirely excluded.

ROSENFELD (A. H.). **Some notes on varietal resistance to streak disease in Egypt and Natal.**—*Int. Sug. J.*, xl, 471, pp. 99–100, 1938.

In view of the fact that certain sugar-cane varieties (including P.O.J. 2714, 2725, and 2883 and Co. 281 and 290) are susceptible to streak disease [*R.A.M.*, xvi, pp. 368, 409] in Egypt, but appear to show marked resistance in Natal (where *Cicadulina mbila* is much more common than in Egypt), and this in spite of the fact that Uba and its *sinense* relatives are equally affected in both countries, the author suggests that in Egypt the disease may possibly be transmitted by some insect which is a more efficient vector than *C. mbila* on varieties other than Uba.

INGRAM (J. W.) & SUMMERS (E. M.). **Transmission of Sugarcane mosaic by the green bug (Toxoptera graminum Rond.).**—*J. agric. Res.*, lvi, 7, pp. 537–540, 1938.

In a series of experiments carried out in 1936 the green bug, *Toxoptera graminum*, was found to transmit mosaic from infected sugar-cane plants to 21 out of 172 healthy canes, 30 of the insects being transferred to each healthy plant. One transfer of mosaic to sugar-cane resulted from the use of green bugs taken from crab-grass (*Digitaria sanguinalis*) showing symptoms of mosaic. In parallel tests [*R.A.M.*, xv, p. 744], *Aphis maidis* transmitted the disease to 40 out of 124 healthy sugar-cane plants. The new vector is stated to be generally distributed throughout the world and to cause heavy injury especially to wheat and oats in the Mississippi Valley. The aphid feeds upon various parts of the sugar-cane plant above the ground and is commonly found on numerous other grasses. Although at present it appears to be less important in the field than *A. maidis* and *Hysteroneura setariae* [loc. cit.], the authors consider that it may become more dangerous under favourable conditions.

SĂVULESCU (T.). **Contribution à la connaissance des Macromycètes de Roumanie.** [A contribution to the knowledge of the Macromycetes of Rumania.]—*Anal. Acad. române*, Ser. III, xiii, Mem. 8, 72 pp., 5 pl., 1938.

The author gives an annotated list of 196 species of macrofungi

belonging to 78 genera and 12 families found in Rumania, including 64 species not previously recorded therefrom. A table is also given showing all the species (568) so far recorded from Rumania.

Săvulescu (T.) & Săvulescu (Olga). **Uredineae novae Romaniae.** [New Uredineae of Rumania.]—Reprinted from 'Hommage au Professeur E. C. Teodoresco', Bucharest, *1937*, 6 pp., 1 col. pl., 2 figs., 1937. [Received May, 1938.]

Latin diagnoses are given of six species of Uredineae new to the flora of Rumania [cf. *R.A.M.*, xvi, p. 776], one of which is also new to science. *Aecidium teodorescui* n.sp., producing circular spots, 2 to 10 mm. in diameter, on leaves of *Berberis vulgaris* in Bessarabia, is characterized by amphigenous pycnidia, 72 to 100 μ in diameter; hypophyllous, more rarely epiphyllous, often ramicolous, tubular aecidia, numbering 80 to 100, densely disposed in large groups, 0·2 to 1 cm. diam., sometimes also solitary, and then on round, often thickened, reddish-brown spots 2 to 10 mm. diam., 1 mm. high by 180 to 210 μ broad, with a white, recurved, denticulate margin, polyhedral peridial cells, 23 to 30 by 20 to 23 μ, with striate walls, the outer 8 to 10 and the inner 3 to 4 μ in thickness; and polyhedral, angular to globose or ellipsoid, densely verruculose, pale orange aecidiospores, 16·5 to 23 by 14·5 to 18 μ, with an epispore 1·5 to 2 μ in thickness.

A. delphinii-consolidae Hollós (*Math. term. Közl.*, xxxv, pp. 1, 12, 13, 1926) was observed on leaves of *Delphinium consolida* in Muntenia in 1930.

D'Oliveira (B.). **Apontamentos para o estudio do género Fusicladium. III. Frutificação conidial dos Fusicladia dendriticum, pirinum e eriobotryae.** [Indications for the study of the genus *Fusicladium*. III. Conidial fructification of *Fusicladium dendriticum*, *F. pirinum*, and *F. eriobotryae*.]—*Rev. agron., Lisboa*, xxv, 2, pp. 140–164, 6 pl., 1937. [English summary. Received March, 1938.]

Dox's agar plus maltose proved to be the most suitable medium for the study at Lisbon, Portugal, of conidial fructification in *Fusicladium dendriticum* [*Venturia inaequalis*], *F. pirinum* [*V. pirina*], and *F.* [*dendriticum* var.] *eriobotryae* [*R.A.M.*, xv, p. 184], isolated, respectively, from apple, pear, and loquat. Conidia may be produced directly on the vegetative mycelium or on differentiated conidiophores. In *V. pirina* the first conidium is formed terminally on a hypha, or laterally on a protuberance of an intermediate mycelial cell. The conidium remains attached to the conidiophore, which continues to grow so that the originally apical position of the conidium becomes a lateral one. From the tip of the new growth a fresh conidium is produced and the process successively repeated. This type of conidiophore presents great irregularities and resembles *Scolecotrichum* or in certain cases of verticillate development may recall the growth habit of *Arthrinium*.

The conidia of *V. inaequalis*, on the other hand, are invariably produced apically on the conidiophore, and at the production of each conidium a new ring is formed. This is believed to represent the authentic type of *Fusicladium* conidiophore development.

In *F. dendriticum* var. *eriobotryae* the manner of conidiophore growth is intermediate between that of *V. inaequalis* and *V. pirina*, a fact that

may account for previous confusion in the classification of the first-named species.

Conidia may be formed in chains, short and rare in *V. inaequalis* and *V. pirina*, long and abundant in *F. dendriticum* var. *eriobotryae*; in old cultures of the last-named the chains may be branched like those of *Cladosporium* and *Hormodendrum*. Short chains of uniseptate conidia, of the *Bispora* type, were also observed on the three species. The conidial dimensions of *V. inaequalis*, *V. pirina*, and *F. dendriticum* var. *eriobotryae* in nature ranged from 12 to 31 by 6 to 10 (mostly 21 to 23 by 8·5 to 9·5), 15 to 40 by 6 to 10 (21 to 24 by 6 to 10), and 11 to 30 by 6·5 to 10 (18 to 20 by 8 to 9) μ, respectively, the corresponding figures in culture being 13 to 55 by 6 to 10 (18 to 24 by 6·5 to 7·5), 15 to 60 by 6 to 10 (20 to 25 by 7 to 8), and 7 to 58 by 5 to 11 (15 to 20 by 7 to 8) μ, respectively. All three species produced both bi- and pluriseptate conidia, the former (*Napicladium*) type being frequent, the latter (*Helminthosporium* and *Cercospora*) rare.

The cytological processes involved in conidial development in the three species under observation are described.

[The present paper was preceded by two others, (I) dealing with the conidial characters of the three species, and (II) describing the type of germination of the conidia (*Agros*, xix, 1, 13 pp., 1936; *Rev. agron., Lisboa*, xxiv, pp. 20–51, 7 pl., 1936). English summaries are supplied in both instances.]

Goto (K.). **Sclerotium rolfsii Sacc. in perfect stage. V. Inoculation studies with natural strains, basidiospores, single basidiospore isolates, and some F 1–, F 2– and back cross strains obtained by mating.**—*Ann. phytopath. Soc. Japan*, viii, 3–4, pp. 203–220, 2 figs., 1938. [Japanese summary.]

In further studies on *Sclerotium rolfsii* in the *Corticium* stage [*R.A.M.*, xvi, p. 280] the author carried out inoculation tests on broad bean [*Vicia faba*], tobacco, tomato, cucumber, castor bean [*Ricinus communis*], and other seedlings with the strains previously used. Inoculations were made by placing cultures in short glass caps, cut from the bases of test-tubes and filled with onion agar, against the bases of seedlings grown in sand culture, so that the mycelium reached the host directly and was kept apart from the soil microflora.

Pathogenicity is correlated to some extent with the author's grouping of the strains of *S. rolfsii*, viz., group I, forming spores readily; group II, forming spores; group III, forming spores scantily; group IV, non-sporing; and group IV 2, a sub-group of IV. *S. delphinii* [ibid., xvi, p. 204] was used for comparison.

Strains of *S. rolfsii* proper, i.e., groups I and II, were rather weakly virulent; group III rather strongly so, while most of IV and *S. delphinii* were strongly virulent.

Hymenial structures were produced rapidly and abundantly by one strain (R 11) of group I, once each in four experiments by the remaining strains of groups I and II, and not at all by the others. *S. rolfsii* proper produced only fluffy mycelium, or mycelium mixed with not very marked strands, while most of the other strains produced strands and less spreading hyphae.

Strains from single basidiospores of *S. rolfsii* are more weakly pathogenic than the F_1 progeny (secondary strains) derived from mating two primary isolates, and in nature might be innocuous. Among the F_2 strains tested, one obtained by mating a very weak and a moderately weak F_1 strain proved to be more virulent than the original parents.

No infections resulted from inoculations with basidiospores.

NIETHAMMER (ANNELIESE). **Die Gattung Penicillium.** [The genus *Penicillium*.]—*Zbl. Bakt.*, Abt. 2, xcviii, 1–4, pp. 65–76, 12 figs., 1938.

Representatives of the genus *Penicillium* (which the writer, following Thom, subdivides into three groups, *Monoverticillium*, *Asymmetricum*, and *Symmetricum* [*R.A.M.*, ix, p. 410]) were found, in extensive recent studies in Czechoslovakia, to be much more numerous in the soil—probably their original home—than on fleshy fruits and seeds. Some well-known species were isolated from virtually untrodden tracts of stone and rock. A marked tendency to sclerotial or perithecial formation, largely disregarded by previous investigators, was observed among many species, the close similarity between the perfect stages of which points to a close interspecific relationship and may ultimately simplify the work of classification. In this connexion the practice of creating new species on the basis of variations in the normal growth habit is deprecated. The habitual failure of *P.* spp. to attack intact fruits may be attributed to their negligible cellulose- and fat-dissolving properties.

GOIDÀNICH (G.). **Studi sulla microflora fungina della pasta di legno destinata alla fabbricazione della carta.** [Studies on the fungal microflora of wood pulp destined for paper-making.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 3, pp. 305–399, 40 figs.; 4, pp. 405–474, 32 figs., 1937. [Received May, 1938.]

In this detailed though preliminary account of investigations carried out in Italy during a period of more than two years into the fungous staining of stored wood pulp destined for paper-making [cf. *R.A.M.*, xii, p. 545; xv, p. 623; xvi, p. 575], the author states that the method used to isolate and culture the organisms was to remove portions of the material in sterilized aluminium receptacles with a screw top, and afterwards to incubate at 25° C. on 5 per cent. meat extract agar. This technique compared favourably with the other standard methods which were tested.

The fungi most frequently isolated were *Fusarium*, *Stachybotrys*, *Trichoderma*, and *Hormodendrum* spp., and those least frequently *Graphium*, *Ophiostoma*, the Basidiomycetes, and *Phialophora*. Certain fungi found on wood pulp in other countries were not isolated, including *Oidiodendron*, *Discula*, *Pullularia*, and *Spicaria* spp.

The following isolations are new records for the genera concerned: *Monilia sitophila*, *Papularia sphaerosperma*, *P. arundinis*, *Pseudeurotium zonatum*, *Haplosporella vivanii* n.sp., and *Sporocybe borzinii*.

The following new species are recorded [with Latin diagnoses]. *H. vivanii* n.sp. is characterized by pycnidia 600 to 1,100 μ in diameter covered with a weft of very dark, rigid, septate, branched hyphae, 2·5 to 5 μ in diameter. The dark, opaque wall averages 60 to 90 μ and may

reach 150 μ in thickness. The central part of the pycnidium is occupied by a layer of irregularly quadrangular or rectangular cells 12 to 21 μ thick, forming a pseudoparenchymatous tissue, usually hyaline, but sometimes pale rose-violet in parts. The colourless, 1-celled, cylindrical or apically attenuated conidiophores measure 5 to 12 by 4 to 5 μ. The ellipsoidal conidia are constricted at the base and measure 15·8 to 28 (usually 19·8 to 22·7) by 6·4 to 12·1 (usually 9·8 to 10·3) μ. The mycelium consists of dark hyphae 6 to 12 μ in diameter, with marked septa at intervals of 27 to 40 μ. Some of the hyphae are hyaline, with almost invisible septa, and measure 1·5 to 3 μ in diameter.

The genus *Burgoa* G. Goid. (syn. *Papulospora* Preuss (1851) em. Hotson (1912) p.p.) is characterized by a hyaline, branched, nodulose mycelium 'septate at the nodes in the manner of a Hymenomycete'. The lateral, intercalary, or apical conidia (termed bulbils or spore-bulbils) vary in colour and size and are formed from a central nucleus of hyaline, polygonal cells; they are budded off from the mycelial hyphae, or are arranged in a spiral. *B. verzuoliana* n.sp. is characterized by hyaline or slightly flavous, branched, nodulose-septate hyphae measuring 3·5 to 4·7 (rarely up to 17) μ in diameter, and round conidia 60 to 130 (generally 70 to 90) μ in diameter, very black when mature. *B. anomala* (Hots.) G. Goid. n. comb. (syn. *Papulospora anomala* Hots.) differs from *B. verzuoliana* chiefly in the manner of formation of the bulbil; it is transferred to *Burgoa* as it has clamp-connexions.

Hormodendrum chamaleon G. Goid. n.sp. differs from *H. elatum* in that both on natural and agar media the elements composing the fructifications readily become detached. The conidiophores are dark at the base, light at the extremity, measure 210 to 420 by 4 to 7 μ, with septa at intervals of 27 to 36 μ; the 1-celled ramoconidia measure 8 to 11 by 3·5 to 4·5 μ, the 2-celled measure 15 to 32 by 3·5 to 4·8 μ, and the conidia measure 5·6 to 8 by 2·8 to 3·5 μ.

Phialophora lignicola (Nannf.) G. Goid. n. comb. (syn. *Lecytophora lignicola* Nannf.) [ibid., xiv, p. 275] is the most characteristic species of its genus. The conidia arise from conidiogenes of different types, of which some are 1-celled, cylindrical, with enlarged extremities and measure 2·5 to 4·8 by 1·8 to 2 μ, while others are phial-shaped, being much swollen and short-necked; both forms are sometimes found attached side by side to the same hypha. A third type of conidiogene is phial-shaped, sessile, or pedicellate, 4·8 to 8·5 μ long, and with a small spore-opening at the distal extremity. The mycelium is generally formed of dark, septate hyphae with smooth parallel walls and 1·8 to 3·6 μ in diameter. Often both the aerial and immersed hyphae show spherical protuberances 5 to 8·3 μ thick, with a thickened wall, generally attached to one another in toruloid, simple, rectilinear, or branched chains up to 120 μ long and capable of producing conidia.

Epicoccum mezzettii n.sp. is characterized by reddish-brown, spherical, pedicillate conidia uniformly 9 to 11 μ in diameter.

Sporocybe borzinii n.sp. is characterized by rectangular, hyaline or light brown conidia measuring 9 to 12 by 3 to 5 μ. Two metagenetic stages occur, one belonging to *Sporotrichum*, with oval or piriform hyaline, usually brown conidia measuring 7 to 10 by 5 to 6 μ, the other approaching *Epidochium*.

Berkeley (G. H.). **Diseases of Tobacco—and their control.**—*Canad. Hort.*, lxi, 3, pp. 65–66; 4, pp. 108–109, 4 figs. (1 on p. 64), 1938.

The following items, in addition to those already noticed from another source [*R.A.M.*, xvi, pp. 636, 637], occur in this popular account of Canadian tobacco diseases. Recent studies at St. Catharines, Ontario, have revealed the existence of several strains of the tobacco mosaic virus, some of which tend more strongly than others to cause 'breakdown' (more or less extensive necrosis) of the foliage, especially the lower leaves.

Some degree of resistance to black root rot [*Thielaviopsis basicola*: ibid., xvii, p. 418] has been shown by Harrow Velvet, Kentucky White Burley, Halley's Special, Station Standup, Standup Resistant, Resistant Havana 142, Havana 142 c–3–x, Havana 236 (Johnson), and Grand Rouge No. 4. During 1937 this disease was severe on Burleys in Essex and Kent Counties, Ontario, due to the exceptionally heavy rains, but was virtually absent in Quebec, where unusually dry conditions prevailed.

Brown root rot [ibid., xvi, p. 67] in Ontario generally affects tobacco crops following maize, soy-beans, or timothy [*Phleum pratense*]. Kelley and Judy's Pride have recently been found to show greater resistance than Harrow Velvet, Halley's Special, Kentucky White Burley, Gay's Yellow, and other Burleys, while among the flue-cured varieties White Mammoth, Bonanza, and Duquesne appear to be less liable to the disease than Yellow Mammoth, White Stem Willow Leaf, Adcock, Jamaica Wrapper, and others.

Several cases of frenching [ibid., xvi, p. 637] were observed both in the seed-bed and field in Quebec and Ontario in 1936 and 1937. The disorder is frequently severe on light soils cropped to tobacco for the first time.

A circular, brown, later nearly white spotting of the leaves, chiefly of flue-cured varieties, common in both provinces, is tentatively attributed to a disturbance in the nitrogen-potassium balance of the soil.

Caldwell (J.) & James (A. L.). **The propagation of Tobacco plants from root cuttings.**—*Phytopathology*, xxviii, 3, pp. 229–230, 1 fig., 1938.

Evidence is briefly adduced to show that mosaic tobacco plants (Virginian variety) can readily propagate themselves by means of root cuttings, and that, at any rate under the mild climatic conditions prevailing at Exeter [New Hampshire], they may constitute an important source of infection for the next season's crop.

Valleau (W. D.) & Johnson (E. M.). **Tobacco mosaic. Sources of infection and control.**—*Bull. Ky agric. Exp. Sta.* 376, pp. 221–262, 1 graph, 1937.

The authors sum up the results of their own and other workers' experiments and observations on the sources of initial infection by tobacco mosaic [*R.A.M.*, xvi, p. 658 and preceding abstract] and arrive at the conclusion that the most common cause of plant bed and field infection is the handling of plants by workers, whose hands have become contaminated with the highly viruliferous air- and fire-cured tobacco

used for smoking and chewing. Even the manufactured tobacco, which contains little or no virus, is stated to be not entirely safe for use during weeding. The presence of infected perennial Solanaceous weeds and of aphids and possibly other sucking and biting insects are considered to be possible but minor sources of infection. Little evidence appears to exist as to the occurrence of initial infection through contaminated soil, although it can admittedly occur in the South, where roots live through the winter. Heavy infection resulted from the application of viruliferous tobacco debris to the land shortly before setting. The control of mosaic must, therefore, depend on keeping all tobacco debris of the previous year's crop away from the bed and field; roguing the mosaic plants to prevent field spread; and having the hands and clothes of the workers, including the pockets, where they may carry fragments of viruliferous tobacco, thoroughly washed and brushed before handling the growing plants.

KÖHLER (E.). **Vergleichende Untersuchungen über die Ausbreitungsgeschwindigkeit verschiedener Stämme des X-Mosaik-Virus in der Tabakpflanze.** [Comparative studies on the velocity of spread of various strains of the X-mosaic virus in the Tobacco plant.]—*Z. PflKrankh.*, xlviii, 3, pp. 118–128, 3 graphs, 1938.

A tabulated account is given of the writer's experiments at the Biological Institute, Dahlem, Berlin, to determine the relative velocity of spread in tobacco plants of four strains of the X-virus of potatoes, viz., Ers m (identical with that formerly known as Ers 25), H 19 m, Cs A, and Mb 12 [*R.A.M.*, xvii, p. 264]. The Ers m and Mb 12 strains were found to migrate much more slowly through their hosts than H 19 m and Cs A, with the result that the plants inoculated with the two former acquire immunity from infection (probably only partial) by other X-strains at a much later period than those inoculated with H 19 m and Cs A. The protective action against other viruses exerted by Ers m appears to be only about half as powerful as that of H 19 m and Cs A, and a similar relationship prevails in respect of Mb 12.

These data place in a somewhat different light the writer's earlier conclusions as to the failure of Ers m and Mb 12 to confer on their hosts a capacity to resist infection by other X-strains. The two strains in question undoubtedly possess the same defensive mechanism as the others under investigation, such differences as exist being merely of degree. It is further doubtful whether differences of this order can properly be used to maintain the existence of two subgroups (J. Johnson and Koch's mottle and ring spot, and Köhler's X_I and X_{II}) within the X-virus. In this connexion it is important to note that, in all the strains tested, the virus is particularly slow in penetrating to the leaf immediately above that selected for inoculation, conveying a misleading impression in immunization experiments unless this fact is borne in mind.

BASSET (J.), GRATIA (A.), MACHEBOEUF (M.), & MANIL (P.). **Action of high pressure on plant viruses.**—*Proc. Soc. exp. Biol., N.Y.*, xxxviii, 2, pp. 248–251, 1 diag., 1938.

In experiments [? at the State Agricultural Institute, Gembloux,

Belgium] to test the resistance of certain plant viruses to high pressures, active, specific tobacco mosaic virus protein, obtained by differential ultracentrifugation, was divided into five parts, one of which remained untreated for control purposes while the others were pressed for 45 minutes at 2,000, 4,000, 6,000, and 8,000 atmospheres, respectively. The control and each of the four pressed samples were then divided into three portions, to the first of which was added an equal volume of anti-tobacco mosaic serum for the flocculation tests; to the second a quarter volume of saturated ammonium sulphate solution containing 5 per cent. acetic acid for the crystallization test, while the third was inoculated into *Nicotiana glutinosa* leaves for the virulence test. The following results were obtained. The control and the samples pressed at 2,000, 4,000, and 6,000 atmospheres responded very similarly to the flocculation test, i.e., by the development of a heavy precipitate in the form of a gel, closely resembling a slowly retracting clot, whereas the precipitate formed by the sample pressed at 8,000 atmospheres was of a totally different character, being reduced to a few small clumps readily undergoing sedimentation. The crystallization test likewise gave similar results for the control and the three first pressed samples, while that submitted to 8,000 atmospheres exhibited an amorphous precipitate in which only a very few crystalline forms could still be detected. The virulence test gave the following number of lesions: 90, 49, 63, 58, and 2 for the control and the four pressed portions, respectively. It is apparent from these data that the specific protein resists the influence of pressure up to 6,000 atmospheres but undergoes a marked change at 8,000.

The second experiment was performed comparatively with plain unpurified juices of tobacco plants infected either with the tobacco mosaic or tobacco necrosis virus [*R.A.M.*, xvi, p. 637], the latter being neutralized by the corresponding antiserum but showing no precipitation and hitherto unobtainable as a crystalline protein. In the virulence test for tobacco necrosis on tobacco, the control sample and that pressed at 3,000 atmospheres gave [an unspecified number of] lesions, whereas none developed from the 5,000 and 8,000 atmosphere samples. In the case of tobacco mosaic on *N. glutinosa*, the numbers of lesions produced by the control, 3,000, 5,000, and 8,000 atmosphere samples were 60, 121, 90, and 39, respectively.

In respect of the tobacco mosaic virus, the outcome of the second test is stated to confirm that of the first, both showing the destructive action of pressure exceeding 8,000 atmospheres, which is well above the usual lethal pressure for certain viruses and close to the denaturing pressure for globulin. On the other hand, tobacco necrosis virus is inactivated between 3,000 and 5,000 atmospheres, the usual virus lethal pressure.

Ross (A. F.) & Stanley (W. M.). **Partial reactivation of formolized Tobacco mosaic virus protein.**—*Proc. Soc. exp. Biol., N.Y.*, xxxviii, 2, pp. 260–263, 1938.

Samples of tobacco mosaic virus protein inactivated at room temperature in reaction mixtures containing 2 per cent. purified virus protein and 2 per cent. formaldehyde [*R.A.M.*, xv, p. 754] in M/10 phosphate

at P_H 7 were removed after varying periods and immediately dialysed against cold distilled water for about six hours in order to stop the reaction by the removal of excess formaldehyde. Dialysis at P_H 3 gave the best results and, since very little change occurred after the third day, a three-day period was adopted for the reactivation procedure. The dialysed solutions of inactivated and reactivated virus protein were adjusted to M/10 phosphate (P_H 7), analysed for total nitrogen, and diluted with M/10 phosphate to concentrations suitable for inoculating against controls containing 10^{-5} or 10^{-6} gm. active protein per c.c.

Nicotiana glutinosa was chosen as the test plant and the half-leaf method of inoculation [ibid., xvii, p. 272] was used, except in the trials for complete or almost complete reactivation, for which whole leaves were employed. The relative activities were interpreted after comparison with dilution curves of active virus and of mixtures of active and inactive virus proteins. Inactive protein was found to reduce the lesion count by 40 to 50 per cent. at a concentration of 10^{-2} gm. per c.c., but had very little effect at 10^{-3}. This reduction was no greater than that caused by comparable amounts of hydrogen peroxide-inactivated virus protein or of egg albumin. Inactivation by formaldehyde cannot be due to an aggregation of particles, for the formolized virus protein has about the same sedimentation constant [ibid., xvi, p. 415] and exhibits approximately the same amount of stream double refraction as does active virus protein. Formaldehyde inactivation causes a decrease in amino-nitrogen and is further accompanied by a decrease in the number of groups (probably the indole nuclei of tryptophane) reacting with Folin's phenol reagent. That formaldehyde is actually bound to the protein is indicated by the fact that, even after many days of dialysis, the formolized proteins give a strong Rosenheim-Acree reaction on the addition of sulphuric acid and an oxidizing agent. These results, together with the fact that during the inactivation of some 99 per cent. of the virus protein the rate approaches that of a monomolecular reaction, are considered to demonstrate that the inactivation is not due to the toxicity of free formaldehyde or of the protein-formaldhyde complex, and that it is probably a sequel to the blocking of amino groups, indole nuclei, or both.

When the reaction was stopped after appropriate periods, preparations retaining about 10, 1, and 0·1 per cent. of their original activity were secured. Following reactivation, these preparations were found to possess approximately 20, 10, and 1 per cent., respectively, of their original activity. Preparations that were inactive when inoculated at a concentration of 10^{-3} gm. per c.c. were appreciably infectious at the same strength after reactivation. The data indicate that two simultaneous reactions occur, one reversible and the other irreversible. The tenfold increase in activity obtainable by the reactivation process is definite and reproducible at will. Evidence that the process in question is accompanied by an increase in amino-nitrogen and in groups reacting with the phenol reagent was obtained by colorimetric estimation.

The demonstration that the addition of formaldehyde to the virus protein results in a simultaneous decrease of activity of amino and reducing groups, and that under conditions favourable to formaldehyde removal virus activity is regained and the number of such groups

increases denotes that some of the latter are at any rate partially concerned in the structural development necessary for virus activity. The formolized virus protein, unlike that inactivated with safranin [ibid., viii, p. 407] or the salts of heavy metals [ibid., xvii, p. 273], is soluble, and it has been proved that the inactivation is not due to toxicity. The inactivation of the virus by formaldehyde, its subsequent reactivation, and the condition of certain groups in each case can best be interpreted in terms of familiar chemical reactions, and constitute direct experimental evidence that virus activity is a specific property of the protein.

BAWDEN (F. C.) & PIRIE (N. W.). **The isolation and some properties of liquid crystalline substances from Solanaceous plants infected with three strains of Tobacco mosaic virus.**—*Proc. roy. Soc.*, Ser. B., cxxiii, 832, pp. 274–320, 4 figs., 1 graph, 1937.

The authors isolated nucleoproteins with characteristic optical properties from Solanaceous plants infected with the mild strain of tobacco mosaic, aucuba mosaic [tobacco virus 6], and [tomato] enation mosaic [strain of tobacco virus 1: *R.A.M.*, xvii, p. 77], while no such proteins have been isolated from healthy plants. These nucleoproteins were found to be infective at a dilution of $1/10^{10}$ and to give specific precipitates with antisera at a dilution of $1/10^{7}$. When the protein content of the highly purified solutions was raised above about 2 per cent. they separated into a lower layer, which was the more concentrated and bi-refringent, and an upper layer, which showed anisotropy of flow. The two layers showed no essential difference in virus activity, expressed in terms of solid content. Anisotropy of flow was easily recognized in solutions containing only 0·02 per cent. of protein. High-speed centrifuging causes the protein to be deposited in the form of a bi-refringent jelly. Drying experiments resulted in a reduction of activity; heating to temperatures of 75° to 80° C. led to a rapid decomposition of the solutions and heating for a few minutes at 90° to 95° caused a complete loss of anisotropy of flow and destroyed the infectivity and the serological activity of the virus preparations.

The physical properties of the preparations and the X-ray measurements are discussed and it is suggested that the constituent particles in purified preparations are rod-shaped and are built up by the linear aggregation of smaller units. The results of filtration experiments with the virus before and after purification indicate that the degree of aggregation is greater in purified preparations than in the untreated infective sap. The authors are inclined to believe that the isolated nucleoproteins are the viruses themselves, there being strong presumptive, although not conclusive, evidence to this effect.

FAWCETT (G. L.). **La corcova del Tabaco y su presencia en las plantaciones de Tomates.** ['Corcova' of Tobacco and its presence in Tomato plantations.]—*Circ. Estác. exp. agríc. Tucumán* 60, 2 pp., 1938.

It was experimentally established in 1937 that the transmission of the 'corcova' ['hunchback'] disease of tobacco and tomato in Tucumán, Argentine Republic [*R.A.M.*, xiii, p. 686], from diseased to healthy

plants is effected by a Thysanopterous insect, *Frankliniella paucispora* Moult. At the optimum temperature for the development of the disease (25° to 30° C.) the incubation period for viruliferous individuals on healthy plants is less than a week, but if a temperature of 35° or above is maintained for several hours daily the symptoms appear slowly or not at all. The larvae of *F. paucispora* proved more reliable than adults as vectors of 'corcova'. Reasonably early sowing of tobacco (in time for transplanting in September or early October) has been found to hold the disease in check; tomato seed should not be sown before May.

The principal symptoms of 'corcova' on tomatoes are a bronze discoloration of the leaves, either spreading uniformly over the surface or localized in figures or concentric spots. The affected foliage withers and severely diseased plants die; if fruit is produced it is small and of poor quality. The stems may show black lesions.

Wickens (G. M.). **A new and serious disease of Tobacco in S. Rhodesia. Preliminary note.**—*Rhod. agric. J.*, xxxv, 3, pp. 181–184, 1 pl., 1938.

During 1936–7, tobacco in Southern Rhodesia became affected by a new disease which appears to be able to spread rapidly and cause very serious loss. The affected plants show severe stunting of the main stem and marked distortion of the young leaves. When young plants are attacked the main stem ceases growth almost entirely, the leaves becoming distorted rather suddenly, with the result that the plants assume a rosette appearance, with healthy leaves spread out horizontally all round and the very small, distorted, younger leaves forming a tightly bunched knot in the centre. If the plants do not adopt this rosette formation, or if they grow out of it, the main stem makes some growth but remains somewhat stunted, and the leaves are small and distorted, the blades curling sharply under at the tips. Plants attacked when rather older are often more severely affected on one side than the other, the flower bending over and sometimes pointing to the ground. The available evidence indicated that the condition is of virus origin and is transmitted by *Myzus persicae*; it is not transmissible by handling.

It is recommended that all affected plants (including hosts other than tobacco, if found) should be removed and destroyed.

Anderson (P. J.). **Downy mildew of Tobacco.**—*Bull. Conn. agric. Exp. Sta.* 405, pp. 61–82, 5 figs., 1937. [Abs. in *Exp. Sta. Rec.*, lxxviii, 5, p. 648, 1938.]

This bulletin gives full information on downy mildew of tobacco (*Peronospora tabacina*) [see above, p. 503], including the history, symptoms, host range, and control of the disease, the effect of meteorological conditions, and a bibliography of 62 titles.

Clayton (E. E.) & Gaines (J. G.). **Blue mould (downy mildew) disease of Tobacco.**—*Fmrs' Bull. U.S. Dep. Agric.* 1799, 16 pp., 9 figs., 1938.

This is a popular account of the symptoms, life-history, and distribution of downy mildew of tobacco (*Peronospora tabacina*) [see preceding

abstract]. Control measures are discussed and both heat treatment and benzol gas treatment are considered too costly. The authors recommend such cultural practices as planting very large seed-beds and delaying transplanting until the diseased plants have recovered, and also spraying with red copper oxide.

REID (J. J.), MCKINSTRY (D. W.), & HALEY (D. E.). **Studies on the fermentation of Tobacco. I. The microflora of cured and fermenting cigar-leaf Tobacco.**—*Bull. Pa agric. Exp. Sta.* 356, 18 pp., 2 graphs, 1938.

This is an expanded, tabulated account of the writers' studies on the microflora of cured Pennsylvania cigar-leaf tobacco foliage and its relation to catalase activity, a preliminary note on which has already appeared [*R.A.M.*, xvii, p. 211].

BAWDEN (F. C.) & PIRIE (N. W.). **A plant virus preparation in a fully crystalline state.**—*Nature, Lond.*, cxli, 3568, pp. 513–514, 1938.

The authors succeeded in isolating a specific protein, which crystallized in the form of rhombic dodecahedra, from tomato plants infected with the virus causing bushy stunt [*R.A.M.*, xvi, p. 727]. This protein appears to be a nucleoprotein but has a rather higher nucleic acid content than those previously isolated from plants infected with other viruses. Solutions of the protein showed no anisotropy of flow, the crystals were also isotropic, and the jelly formed by sedimenting the protein in a centrifugal field of 16,000 times gravity was not bi-refringent. The protein was isolated from the infective sap, after clarification by heating to 60° C. and centrifuging, by repeated precipitations at room temperature with one quarter saturated ammonium sulphate solution. It was possible to fractionate impure preparations by means of trypsin or a high-speed centrifuge. Crystallization was best effected by adding ammonium sulphate to a neutral solution at room temperature until the appearance of the first sign of turbidity, immediately cooling to 0° C., and then slowly warming to room temperature. The protein was more soluble at 0° than at room temperature and it crystallized when the clear fluid was warmed. Analyses of dried preparations gave the following results: carbon 47, hydrogen 7·3, nitrogen 16, phosphorus 1·3, and carbohydrate 6 per cent. Infections in the form of local lesions were produced by rubbing the leaves of *Nicotiana glutinosa* with 1 c.c. of solutions containing 10^{-7} gm. of this protein, and 1 c.c. of solutions containing 10^{-6} gm. gave a visible precipitate with its antiserum. The activity of a preparation was unchanged by repeated recrystallizations or by sedimentation in a high-speed centrifuge.

KADOW (K. J.), ANDERSON (H. W.), & HOPPERSTEAD (S. L.). **Control of Sclerotinia and Botrytis stem rots of greenhouse Tomatoes and Cucumbers.**—*Phytopathology*, xxviii, 3, pp. 224, 226–227, 1 fig., 1938.

Under Illinois conditions the stem and fruit rots and blossom blight of greenhouse cucumbers and tomatoes caused by *Sclerotinia libertiana* [*S. sclerotiorum*] and *Botrytis cinerea* [*R.A.M.*, xi, p. 621; xvii, p. 418] are ordinarily of little importance, but during the damp, cloudy spring

of 1935 the losses from these diseases in the Chicago area amounted to between 60 and 75 per cent., while the total reduction for Cook County averaged 15 to 20 per cent. The treatment usually recommended for the control of the fungi (soil sterilization and spraying with 4–4–50 Bordeaux mixture) not being altogether reliable, a new method was devised involving the application to the cavities formed by the excision of diseased stem tissue of a thick Bordeaux paste consisting of 1 part of copper sulphate to 2 of lime-sulphur and water as required. This procedure is equally successful on both tomatoes and cucumbers, though the latter may react by slight foliar chlorosis. No absolutely effective means of combating *B. cinerea* on cucumber and tomato blossoms and fruits has yet been found, but the fungus causes much less damage to these organs than to the stems.

KALANDRA (A.) & PFEFFER (A.). **Duležitejsi a pozoruhodnejsi poskozeni, choroby a škudci lesnich dřevin v letech 1935–1936 v Československu.** [The most important and noteworthy troubles, diseases, and pests of forest trees in Czechoslovakia in the years 1935–6.] —*Ochr. Rost.*, xiv, 55, pp. 24–33, 1938. [German summary.]

In the first section of this report Kalandra gives a briefly annotated list of the more important physiological troubles and fungal diseases which were recorded in 1935–6 on forest trees in Czechoslovakia, and among which the following may be mentioned. In some nurseries first-year seedlings of *Picea excelsa* [*P. abies*] were badly attacked by a blight associated with *Fusarium* spp., and those of *Pinus sylvestris* were very extensively killed by *Botrytis cinerea*. *Ascochyta piniperda* [*R.A.M.*, xv, p. 618] was found associated with a die-back of *P. abies* shoots, and *Cytospora* sp. with areas of dead bark on the trunk of middle-aged trees. *Thelephora laciniata* [ibid., x, p. 271] caused fairly severe damage to young trees of *P. abies* and *Abies alba*. In one locality the cones of *P. abies* were severely attacked by rust (*Aecidium strobilobium*). *Lophodermium pinastri* [ibid., xvi, p. 847; xvii, p. 360] was extremely destructive on two-year-old *Pinus sylvestris* seedlings throughout the country, but was of minor importance on those of *P.* [*nigra* var.] *austriaca*. In one locality *Phoma abietis* was found killing the shoots of young *A. alba* trees. While apparently on the decrease, the Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*) [ibid., xvi, p. 424] is still fairly prevalent in certain localities, and is correlated with the epidemic occurrence of bark beetles (*Scolytus scolytus*, *S. multistriatus* [ibid., xvii, p. 141], and *S. pygmeus*). In south Bohemia Canadian poplar (*Populus canadensis*) was observed to be attacked by *Cytospora chrysosperma* [ibid., xvi, p. 797], this being apparently the first record of the fungus from Czechoslovakia. Oak railway sleepers were observed in Prague to be heavily rotted by *Stereum frustulosum* [ibid., xvi, p. 4].

LA FUZE (H. H.). **Specificity of three wood-destroying fungi for Gymnosperm and Angiosperm woods.**—*Proc. Ia Acad. Sci., 1936*, xliii, p. 157, 1937. [Received May, 1938.]

Certain differences in the nutritional characteristics of *Polyporus betulinus* [*R.A.M.*, xiii, p. 604], *Polystictus versicolor* [ibid., xvi, pp. 221, 580, *et passim*], and *Fomes pinicola* [ibid., xiv, pp. 193, 795] appear

from studies at the Iowa Department of Botany to be correlated with divergences in the chemical analyses of Gymnosperm and Angiosperm woods. In this connexion special mention may be made of the water-soluble extractives containing simpler carbohydrates and the pentoses in coniferous woods, the most frequent hosts of *F. pinicola*. Both this organism and the birch fungus, *Polyporus betulinus*, showed high reductase activity, a phenomenon reported to be common among the brown rot fungi on Gymnosperm, birch, and alder woods. On the other hand, *Polystictus versicolor*, which attacks a wide variety of Angiosperm woods in nature, displayed a high oxidase activity and uniform growth on various carbohydrates in artificial nutrient media.

W.P.A. crews find copper sulphate effective against Dutch Elm disease. —*J. For.*, xxxvi, 3, p. 342, 1938.

Excellent results are stated to have been obtained by employees of the Works Progress Administration in New Jersey in the control of Dutch elm disease [*Ceratostomella ulmi*: *R.A.M.*, xvii, p. 278] by packing copper sulphate into a narrow strip of sapwood, which is then re-covered by bark and a patch of oilcloth applied. The tree is usually killed, and with it the fungus and its carrier beetles [*Scolytus scolytus* and *S. multistriatus*], in five or six days. This method of control has been chiefly used in the wooded rural areas of the State, where 80 per cent. of the infected trees are found. The campaign against the Dutch elm disease in New Jersey is being waged by 2,824 workers, and so far the sum of $438,474 out of a total of $1,095,000 allocated for the purpose has been spent.

Roberg (M.). **Über den Erreger der Wurzelknöllchen europäischer Erlen.** [On the agent of the root nodules of European Alders.]—*Jb. wiss. Bot.*, lxxxvi, 3, pp. 344–349, 1938.

The results of cross-inoculation experiments in 1936 and 1937 at Breslau, Germany, on alder seedlings in a synthetic nutrient solution with a suspension of ground root nodules isolated from each of four species, viz., *Alnus glutinosa*, *A. incana*, *A. cordata*, and *A. viridis*, showed that *Actinomyces alni* [*R.A.M.*, xvi, p. 562] was responsible in all cases for the formation of the rhizothamnia. Only healthy seedlings reacted to inoculation by nodule production.

Blattný [C.]. **Virová choroba 'maly list' a pohárovitost listů Lipy.** [The virus disease 'little leaf' and cup-like malformation of the leaves of Lime trees.]—*Ochr. Rost.*, xiv, 55, pp. 80–81, 1938. [German summary on p. 98.]

The author states that in several localities in Bohemia, Czechoslovakia, he observed in small-leaved lime trees (*Tilia cordata*) a condition which he descriptively terms 'little leaf' as it is characterized by a very severe stunting of the foliage, associated with interveinal discolorations; the disease may affect separate sections of a tree or whole trees, the diseased portions occasionally failing to produce flowers; in bad cases the condition may terminate in the death of the tree or of the affected branches. The fact that the disease symptoms were reproduced in branches of healthy trees, into which bast tissues of diseased

trees were introduced, is held to demonstrate that the condition is caused by a virus. Large-leaved lime trees (*T. grandifolia*) [*T. platyphyllos*] growing in close proximity to diseased *T. cordata* did not develop symptoms of 'little leaf', but their leaves assumed a cup-like shape, frequently with the edges united. Histological studies of such trees indicated the probability that this condition is also due to a virus, possibly related to that of 'little leaf'.

Van Vloten (H.). **Het onderzoek naar de vatbaarheid van Populieren voor aantasting door Dothichiza populea Sacc. et Briard (eerste verslag).** [The inquiry as to the susceptibility of Poplars to attack by *Dothichiza populea* Sacc. & Briard (preliminary report).]—Reprinted from *Tijdschr. ned. Heidemaatsch.*, *1938*, 3, 18 pp., 4 figs., 2 graphs, 1938. [English summary.]

Particulars are given of the preliminary results in a series of experiments, which is in progress in Holland, to determine the specific reaction of poplars to infection by *Dothichiza populea*, this name being retained in preference to Klebahn's proposed *Chondroplea populea* [*R.A.M.*, xvi, p. 572] on account of the incomplete description of spore formation in the latter.

Inoculation during the dormant stage gave rise to more severe symptoms than those developing when the operation was deferred until growth had started. Cuttings and newly transplanted trees sustained the heaviest damage. On the whole, the Tacamahac group [*Populus tacamahacca*] proved to be more susceptible to *D. populea* than representatives of the Aigeiros category, but *P. candicans* and *P. berolinensis* showed a fair degree of resistance. Most of the hybrids developed in the United States by Stout and Schreiner were also susceptible, some degree of resistance being shown, however, by the Rumford (*P. nigra* × *P. laurifolia*), Maine (*P. candicans* × *P. berolinensis*), and Andover (*P. nigra* var. *betulifolia* × *P. trichocarpa*) poplars. Within the Aigeiros group the most resistant species were *P. fremontii*, *P. brabantica*, *P. marilandica*, *P. eugenei*, *P regenerata*, and *P. serotina* var. *erecta*.

Malençon (G.). **L'Hypoxylon sertatum D.R. et Mtgn., parasite des Chênes-liège marocains.** [*Hypoxylon sertatum* Dur. & Mont., a parasite of Moroccan Cork Oaks.]—*Bull. Soc. Sci. nat. Maroc*, xvii, 2, pp. 127–131, 1937.

Hitherto the only two virulent fungal pathogens of the cork oak [*Quercus suber*] known in Morocco were *Xanthocrous* [*Polystictus*] *cuticularis* and *Ungulina fomentaria* [*Fomes fomentarius*: *R.A.M.*, xvi, p. 4], but a third parasite causing even more severe damage has recently been detected in the Mamora forest, near Rabat. *Hypoxylon sertatum* enters the host through the outermost twigs, the tips of which wither and die, and thence gradually proceeds along the larger branches to the trunk; at this stage the attack generally assumes a destructive character and the tree rapidly succumbs. Fusoid longitudinal fissures, up to 50 to 60 by 4 to 8 cm., soon develop on the dead areas of the branches or trunk; the base of the cracks is occupied by the carbonaceous stroma of the fungus, dull black at first, later glistening as the

finely papillate, globose or oval spores, 5 to 8 μ in diameter, are extruded through the perithecial ostioles.

Infection appears to take place through the wounds, frequently inflicted on the young, growing tissues during humid spring weather by *Lymantria dispar*. Once entry to the host is gained, the mycelium produces in the cortical tissues two groups of brown, septate, fairly coarse hyphae, one consisting of nearly straight elements which penetrate into the depths of the cortex and rapidly proceed through the phloem down the branch towards the trunk. The hyphae of the second category, arising perpendicularly from the foregoing, pursue an erratic course, and frequently form fresh hyphae of the first type which invade the suberophellodermic layer. These separate phases of infection can only be recognized in the initial stages of invasion; later all the cortical tissues except some sclerotic cells become disorganized, the dead tissues soon developing a typical black discoloration. Finally the parasite enters the xylem, usually through the medullary rays, but the only effects on this portion of the host are a slight softening and the formation of brown or blackish lines.

The author proposes a new section of *Hypoxylon* named *Cryptoxylon* to take this species, which, though new to the flora of Morocco, has been reported on cork oak from Algeria and on one occasion on a walnut from France; it was further observed in January, 1937, on a fallen branch of *Eucalyptus robusta* at Rabat.

Direct control measures being obviously impracticable on a large scale, attention should be directed towards general silvicultural hygiene, followed if necessary by the substitution of pines or some other immune species for *Q. suber*.

KALANDRA (A.). **Nová sypavka u nás působená houbou Hypodermella sulcigena (Rostr.) Tub. na Borovici obecné a Kleči v Tatrách a na Šumavě.** [A leaf-cast disease new to our country caused by *Hypodermella sulcigena* (Rostr.) Tub. on Scots Pine and Mountain Pine in the High Tatra and Šumava.]—*Ochr. Rost.*, xiv, 55, pp. 38–46, 1 pl., 1938. [English summary.]

A brief account is given of an outbreak in 1936–7, apparently the first recorded in Czechoslovakia, of *Hypodermella sulcigena* [*R.A.M.*, xii, p. 255] on *Pinus sylvestris* and *P. montana* in some mountain districts of the High Tatra, Slovakia, and Bohemia. In a few rare instances mature apothecia of the fungus were found in association with mature pycnidia of *Hendersonia acicola* [ibid., ix, p. 146] on the same pine needles. Infected needles received from the High Tatra showed a much more abundant association of *Hypodermella sulcigena* with a pycnidial fungus probably identical with *Hendersonia montana* Vuill. The fact that the majority of the pycnidia were observed to be formed inside the tissues of the developing apothecia of *Hypodermella sulcigena* inclines the author to believe that they are the conidial stage of the latter. The pycnidia are light brown to dark brownish black, more or less globose, with a prominent ostiole, and mostly 82 (rarely 41) to 168 μ (exceptionally 256 to 352 μ) in diameter. The pycnospores are hyaline, later yellowish- to olivaceous-brown, straight to slightly curved, one- to five-celled (usually four-celled), slightly constricted at the septa, and 24 to

55 by 3 to 6 μ (mostly 27 to 36 by 4 to 5 μ) in diameter. It is believed that heavy outbreaks of the disease may be controlled with applications of Bordeaux mixture.

FAULL (J. H.). **Pucciniastrum on Epilobium and Abies.**—*J. Arnold Arbor.*, xix, 2, pp. 163–173, 1938.

This is a study of two species of *Pucciniastrum*, both of which develop their haploid phase on *Abies balsamea*, viz., *P. abieti-chamaenerii* Kleb. from *Epilobium angustifolium*, belonging to the subgenus *Chamaenerion* of *Epilobium*, and the rust conveniently designated *P. epilobii* Otth apud Sydow from *E. adenocaulon*, belonging to the subgenus *Lysimachion*. The life-history of the latter rust is recorded in this paper for the first time. The results of inoculation experiments [which are described in detail] show that the rust originating from *E. angustifolium* does not infect *E. adenocaulon* either by aecidiospores or uredospores, nor can the rust originating from the latter host infect the former. The aecidia of the *E. angustifolium* rust are 0·012 to 0·025 mm. in diameter and have fragile peridia and very finely warted aecidiospores, averaging 15 by 19 μ, while those of that from *E. adenocaulon* measure 0·02 to 0·04 mm. in diameter and have a persistent peridium, and subcoarsely warted aecidiospores, 14 by 18 μ. The corresponding uredospores average 16 by 19 μ and 14 by 19 μ, with peridial cells up to 1·5 and 2·5 μ, respectively, in thickness. Apart from these morphological distinctions, the two rusts exhibited the following differences. The *E. angustifolium* rust occurred more frequently and more severely on the needles of the upper part of the current season's growth, while that from *E. adenocaulon* rust occurred more often on the lower part of it, the peridermia were produced within an average of 17 and 20 days after inoculation by the two rusts, respectively, and the average number of peridermia per infected needle were 33 and 27, respectively. Field experience and controlled cultures showed that *A. balsamea* is highly susceptible to these rusts, which often cause severe damage to young trees.

Discussing the somewhat unsettled taxonomic situation the author considers that these two rusts should be nomenclatorially differentiated, preferably as distinct species, and proposes that the name *P. abieti-chamaenerii* Kleb. be retained for the *E. angustifolium* rust and the usual *P. pustulatum* (Pers.) Diet. in part adopted for that from *E. adenocaulon* rust, since it seems probable that Otth's material was the rust on *E. angustifolium*.

HIRT (R. R.). **Relation of stomata to infection of Pinus strobus by Cronartium ribicola.**—*Phytopathology*, xxviii, 3, pp. 180–190, 2 figs., 1938.

Full details are given of inoculation experiments with *Cronartium ribicola* on white pine (*Pinus strobus*) needles [see next abstract] at two localities in New York State, which resulted in the direct penetration of the epidermal cells by sporidial germ-tubes, herein reported for the first time. Penetration occurred through both dorsal and ventral surfaces of the needles and the germ-tubes either retained their normal width in passing through the cell walls or formed a fine, needle-like

extension at the tip; no appressorium was formed and no swelling of the germ-tubes within the tissues was observed. Stomatal activity appears to be of little or no importance in relation to blister rust penetration, none of the germ-tubes having grown through a stomatal pore into a needle but having rather tended to develop along the epidermal surface in another direction. The negative results of these observations do not of course exclude the possibility of stomatal penetration by *C. ribicola*, but merely point to direct epidermal infection as the more common method of attack.

Buchanan (T. S.). **Blister rust damage to merchantable western White Pine.**—*J. For.*, xxxvi, 3, pp. 321–328, 1 graph, 1938.

To procure data on the nature of white pine (*Pinus monticola*) blister rust (*Cronartium ribicola*) [*R.A.M.*, xvii, p. 494] infection and probable damage to merchantable stands the Division of Forest Pathology examined three infested areas in British Columbia in 1927 [ibid., xiv, p. 66], a total of 534 trees, 5 to 16 ft. in height, constituting the basis. With a view to comparing the results with Inland Empire conditions, 12 infected trees, 66 to 192 ft. in height, were critically inspected in 1936 in the Clearwater region of Idaho.

The outcome of these combined studies shows that infection may take place in the crowns of even the tallest trees, while under conditions favouring the rust, 50 per cent. or more of the merchantable timber in a stand may suffer damage from a relatively short period of exposure (six years) to blister rust on *Ribes* (*R. lacustre*, *R. divaricatum*, and *R. bracteosum* in British Columbia, *R. petiolare* and *R. viscosissimum* in Idaho).

York (H. H.). **Inoculations with forest tree rusts.**—*Phytopathology*, xxviii, 3, pp. 210–212, 1 fig., 1938.

In June, 1927, about 200 shoots each of *Pinus resinosa*, *P. sylvestris*, *P. radiata*, and *P. ponderosa* were inoculated near Woodgate, New York, with aecidiospores of the Woodgate rust (*Peridermium* sp.) [*R.A.M.*, xvii, p. 422] by means of a celluloid cone, 22 in. in length and 3 and 1½ in. in diameter at the two ends, which was slipped over the infected parts and anchored to the stem by means of a copper wire. A strip of absorbent cotton, 8 to 10 by 1 in., saturated in water, was pushed through the narrower end well down the inside of the cone, the entire outer surface of which was wrapped with wet absorbent cotton to a thickness of 1 to 1½ in. The cones were left on the shoots for 24 to 36 hours.

Within four to six weeks infection spots appeared on the stems of all the species of pine used in the test, those on *Pinus sylvestris* frequently being so abundant as to colour the whole stem surface reddish-brown by the end of August. Aecidiospore germination was much more profuse in the inoculation chambers (75 per cent.) than in water cultures (25 per cent.), and anastomosis was considerably more extensive in the former case. It is possible that the Woodgate rust may prove to be one of the western gall group, the alternate hosts of which are members of the Scrophulariaceae, but inoculation experiments on two of the

latter (*Chelone glabra* and *Scrophularia leporella*) with aecidiospores gave negative results.

The celluloid chamber technique also proved very convenient and reliable for inoculation experiments with *Cronartium ribicola* [see preceding abstracts].

Crandall (B. S.). **A root and collar disease of Pine seedlings caused by Sphaeropsis ellisii.**—*Phytopathology*, xxviii, 3, pp. 227–229, 1938.

During the investigation of the root disease of *Pinus resinosa* seedlings in Maryland due to *Phytophthora cinnamomi* [*R.A.M.*, xvi, p. 159], many of the 3- to 5-year-old seedlings in two nurseries were found to be suffering from an atypical foot rot characterized by a deep red discoloration of the bark tissue, with black streaks continuing into the xylem and often persisting throughout the entire stele. Similarly affected 5- or 6-year-old *Pinus strobus* trees were received from a Wisconsin plantation. The fungus isolated from the diseased *P. resinosa* and *P. strobus* tissues was identified by N. E. Stevens as *Sphaeropsis ellisii* [*Diplodia pinea*: ibid., xvi, pp. 75, 787], hitherto associated exclusively with a twig die-back of various conifers. In inoculation experiments both *D. pinea* and *Phytophthora cinnamomi* proved to be strongly pathogenic to 3-year-old *Pinus resinosa* seedlings, while less extensive infection was caused by *Pestalozzia funerea*; on the other hand, the controls inoculated with *Sclerotium bataticola* [*Macrophomina phaseoli*] and sterile rice remained healthy. In one test, *Phytophthora cinnamomi* invaded the tissues for an average of 7·5 cm. in each direction from the collar in 18 days, while *D. pinea* progressed 5·5 cm. downwards and 12 cm. upwards. In both cases all the infected seedlings were killed.

Jessen (W.). **Phosphorsäuremangelerscheinungen bei verschiedenen Holzarten.** [Phosphoric acid deficiency symptoms in various kinds of trees.]—*Phosphorsäure*, vii, 3, pp. 263–270, 5 figs., 1938.

Details are given of experimental observations at the College of Forestry, Hann.-Münden, Germany, on a disturbance of larches, pines, and spruces due to phosphoric acid deficiency and manifested by a dark greyish- to bluish-green discoloration of the needles [*R.A.M.*, xvi, p. 357]. In the case of the larches and spruce this abnormal condition persisted until the autumn, occasionally accompanied in the spruces by a reddish-purple discoloration, whereas the tips of the pine needles turned crimson to purple in the late summer. Larches and pines in a forest soil receiving liberal applications of lime also showed definite symptoms of phosphoric acid deficiency. In general, the chemical analyses undertaken in connexion with these observations revealed no striking reduction of the phosphoric acid content of the soil and it is concluded that the phosphoric acid is presumably merely immobilized by the excess of lime.

Cummins (J. E.). **Some modern aspects of wood preservation.**—*Proc. Soc. chem. Industr., Vict.*, xxxvii, 5–8, pp. 1275–1296, 1937. [Received April, 1938.]

The writer critically surveys some outstanding recent developments

in the treatment of timber against fungi and insects, reference to most of which has been made from time to time in this *Review*.

TOMPKINS (C. M.) & THOMAS (H. R.). **A mosaic disease of Chinese Cabbage.**—*J. agric. Res.*, lvi, 7, pp. 541–551, 5 figs., 1938.

A mosaic disease of Chinese cabbage (*Brassica pe-tsai*) [*R.A.M.*, x, p. 504] was observed in 1934 in central California during the autumn and winter months, causing a slight stunting of the plant and a systemic clearing of the veins, followed by general mottling, with little or no distortion of the leaves. Greenhouse experiments showed that the disease was easily transmitted by the cabbage aphid (*Brevicoryne brassicae*) and the green peach aphid (*Myzus persicae*) and by means of mechanical inoculation with juice, using carborundum as an abrasive, but not through the seed; the incubation period was 13 to 22 days. The host range of the virus appeared to be confined to the Cruciferae, although local lesions were obtained on *Nicotiana glutinosa* and tobacco. The virus retained infectivity after storage for 3 but not for 4 days at 22° C.; after being diluted to 1 in 5,000 but not at 1 in 6,000; and after an exposure for 10 minutes at 73° but not at 75°. A comparative study of the symptoms produced by the Chinese cabbage, cauliflower, and turnip mosaic viruses on Chinese cabbage, Winter Colma cabbage, and Purple Top White Globe turnip showed that the viruses could easily be differentiated on these hosts.

HILLE (E.). **Betrachtungen über die Düngung der Zuckerrüben unter besonderer Berücksichtigung der Phosphorsäure und des Borsuperphosphats.** [Reflections on the manuring of Sugar Beets with special reference to phosphoric acid and boron superphosphate.]—*Zuckerrübenbau*, xx, pp. 37–45, 1938. [Abs. in *Chem. Zbl.*, cix (i), 19, p. 3680, 1938.]

The application of lime, green, liquid, and stable manures, nitrogen, phosphorus, and potash to German sugar beet crops is discussed. Phosphoric acid is considered to be particularly valuable as a means of increasing yield and sugar content, besides facilitating the sugar-manufacturing processes by raising the alkalinity of the cell juices. Heart and dry rot [*R.A.M.*, xvii, p. 286] may be practically suppressed by soil treatments with borax or boron superphosphate at the rates of 15 to 20 kg. and 300 to 400 kg., respectively, per hect.

SCHMIDT (HERTA). **Beitrag zur Kenntnis der Wirkung von Beizmitteln auf künstlich infizierte Gemüsesamen.** [A contribution to the knowledge of the effect of steeping materials on artificially infected vegetable seeds.]—*Gartenbauwiss.*, xii, 1, pp. 89–115, 8 figs., 1938.

Cucumber seeds used in steeping experiments were first artificially inoculated with *Cladosporium cucumerinum* [*R.A.M.*, xvii, p. 364] and *Gloeosporium lagenarium* [ibid., xvi, p. 228] and bean [*Phaseolus vulgaris*] seeds with *Colletotrichum lindemuthianum* [ibid., xvii, p. 5]; the wet method of inoculation, where the seeds were steeped for 10 to 15 minutes in a spore suspension and then dried on blotting-paper at room temperature, yielded better results than the dry method, where pieces of mycelium were put on the seeds. A decrease of infection, but not always complete control, was obtained by steeping the seeds in the

following materials: (*a*) wet: uspulun, ceresan, and fusariol at concentrations of 0·25 and 0·5 per cent., 15 minutes' immersion, and germisan at a strength of 0·125 per cent., 15 minutes; and (*b*) dry: ceresan at concentrations of 2 and 4 per cent., and fusariol, tutan, and abavit-neu at 2 per cent. In the case of *G. lagenarium* the best results were obtained with ceresan wet and dry and fusariol wet; in the case of the other two fungi equally good results were obtained with all the tested materials. The germinability of bean seeds infected with *C. lindemuthianum* was, however, under unfavourable conditions, distinctly decreased by tutan, fusariol dry, and possibly abavit.

FUKUSHI (T.). **The relation of aphids to the transmission of vegetable mosaics.**—*J. Sapporo Soc. Agric. For.*, xxix, 139, pp. 189–216, 5 pl., 1937.

In the course of his studies on the transmission of vegetable mosaics by *Myzus persicae*, following the first outbreak of a mosaic disease on pea and broad bean [*Vicia faba*] plants, grown in the vicinity of red clover [*Trifolium pratense*] plots in Sapporo in 1935, the author transmitted the red clover mosaic through the agency of *M. persicae* to French bean [*Phaseolus vulgaris*], pea, broad bean, red clover, crimson clover [*T. incarnatum*], and alsike clover [*T. hybridum*]; the pea disease to pea, broad bean, crimson clover, and alsike clover; and the broad bean disease to pea, broad bean, sweet pea, and red clover. In the case of pea, broad bean, red clover, and alsike clover the resulting symptoms were similar to those occurring in the field, but the symptoms developing on the French bean plants differed considerably from those of the bean mosaic. The aphids often acquired the virus after feeding for 5 minutes on diseased red clover, pea, and broad bean plants. Single aphids transmitted red clover mosaic virus to healthy pea plants within 10 minutes and similarly the broad bean mosaic to healthy broad bean plants within 30 minutes. The insects retained the red clover mosaic virus for about 30 minutes when allowed to feed, and for about one hour when kept without access to food plants; after this time the infectivity was gradually reduced and eventually lost after about 5 hours. It appears that this virus requires either a very short or no incubation period in aphids and is transmitted mechanically from diseased to healthy plants. It was found that only a small proportion of aphids was capable of transmitting the pea and broad bean virus. *M. persicae* was observed in the greenhouse to multiply abundantly on alsike clover and crimson clover and less readily on pea and broad bean, while red clover appeared to be an uncongenial food plant. It is uncertain whether under natural conditions *M. persicae* actually transmits the disease from alsike clover and red clover to pea and broad bean plants, but in view of the experimental results it is concluded to be not improbable.

ANDREYEFF (N. I.). Новая для Союза вирусная болезнь Лука. [A virus disease of Onion new to U.S.S.R.]—*Symp. Res. Wks, Azoff-Black Sea agric. Coll., Persianovka, 1937*, 5, pp. 125–130, 2 figs., 1937. [Received June, 1938.]

The author describes in full the symptoms of a virus disease of onion,

observed in 1934–5 at the plant-breeding station near Novocherkassk (Azoff-Black Sea Region), believed by him to be recorded for the first time in U.S.S.R. [but see *R.A.M.*, xvii, p. 91]. The disease is stated to resemble very strongly the 'Rotzkrankheit' disease in Germany [ibid., xvi, p. 724] and slime disease or yellow dwarf in the United States [ibid., xvii, p. 221], although the author is inclined to attribute the chlorotic appearance and occasional dwarfing of the flower stalk to the activity of mildew [*Peronospora schleideniana*: ibid., xvi, p. 651].

The Agricultural Pests Ordinance, 1917. (No. 2 of 1917.)—2 pp., 1938.

Under the 'Plant Importation Rules, 1938' (section 18 of the Agricultural Pests Ordinance, 1917), cancelling Gazette Notification 100 of 1933, permits from the Director of Agriculture are required for the importation into North Borneo of all plants, which must be accompanied by an official certificate of freedom from pest and disease or of fumigation. Scheduled plants, i.e., cotton, sugar-cane, coco-nut (seed nuts), living and growing palms, coffee, suckers of bananas (*Musa sapientum* and *M. cavendishii* or *M. chinensis*), plantains (*M. paradisiaca*), and abaca (*M. textilis*), oil palm seeds, tea (all parts including seeds), and suckers, tops, or other living organs of pineapple, must be accompanied by a duly authenticated certificate, in scheduled form, attested by the competent authority in the exporting country and vouching for the freedom of the plants from any injurious pest or disease. Sandakan and Jesselton are the sole authorized places of entry into North Borneo for plant consignments.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, x, 2, pp. 40–41, 1938.

Lithuania. An Order of 18th December, 1937, prescribes that consignments of potatoes imported into Lithuania must be free from wart disease (*Synchytrium endobioticum*), must originate in countries exercising a rigid surveillance of imported material and in which wart disease has not been recorded during the last ten years, and must contain a total of not more than 3 per cent. infection by *Spongospora* [*subterranea*], *Actinomyces* [*scabies*], *Rhizoctonia* [*Corticium solani*], and *Phytophthora* [*infestans*], and 0·25 per cent. [unspecified] wet rot.

Efimoff (A. L.), Kazas (I. A.), Kradinova (Mme M. D.), Obolensky (V. N.), & Shtsherbinovsky (N. S.). Карантин растений в СССР. [Plant quarantine in U.S.S.R.]—*Publ. НКЗ СССР, Сект. внеш. и внутр. Карант. Растений.* [*U.S.S.R. People's Commissariat Agric. Sect. intern. extern. Pl. Quar.*], *Moscow*, 254 pp., 84 figs., 1937. [Received June, 1938.]

This is a revised edition of the official list of insect pests and plant-pathogenic bacteria and fungi falling under the 1935 plant quarantine regulations [*R.A.M.*, xv, p. 399], supplemented by detailed descriptions of each disease, with notes on its geographical distribution, control measures, and quarantine regulations existing in other countries.

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Smart (Helen F.). **Types and survival of some microörganisms in frozen-pack Peas, Beans, and Sweet Corn grown in the east.**—*Food Res.*, ii, 6, pp. 515–528, 1937.

The writer discusses and tabulates the data resulting from a microbiological examination of fresh and frozen samples from the Arlington Experiment Farm, Rosslyn, Virginia, of 14 varieties of green and wax beans [*Phaseolus vulgaris*], 35 of maize (sweet corn), and 8 of Lima beans [*P. lunatus*], as well as of 18 pea varieties in the frozen state only [cf. *R.A.M.*, xvii, p. 538]. The predominating moulds isolated from fresh beans were *Cladosporium* and *Penicillium* spp., *Monilia* and *Rhizopus* spp., however, also being present. Two yeasts, a red torula and *Endomyces* sp. (the latter predominating), were also isolated from this material. A species of *Monilia* was the principal organism found in frozen bean samples, from which species of *Cladosporium* and *Endomyces* had apparently been eliminated. Fresh sweet corn yielded species of *Monilia*, *Oidium* [*Oospora*], *Fusarium*, *Penicillium*, and *Rhizopus*, the two first-named predominating, as they do also in the frozen material from which *Fusarium* was absent. The predominating yeast in these samples, both fresh and frozen, was a *Saccharomyces*. Species of *Dematium*, *Penicillium*, *Cladosporium*, and *Monilia* were isolated from fresh Lima bean samples, the two first-named predominating; *Cladosporium* was absent from frozen material, which yielded chiefly *Monilia*. A red and a brown torula, and species of *Saccharomyces*, *Aspergillus*, *Monilia*, and *Penicillium* occurred in profusion in frozen peas, which also contained *Rhizopus*. The pre-treatment of scalding the vegetables and freezing and storage at —17·8° C. (0° F.) for five to seven months reduced the average microbial content of green and Lima beans and sweet corn by 99·8, 97·2, and 94·6 per cent., respectively, but nevertheless some of the sweet corn packs still yielded up to 1,000,000 per gm., chiefly soil types which succumbed to scalding in the case of the vegetables.

Wilson (R. D.). **A selective medium for Bacterium medicaginis var. phaseolicola (Burkholder) Link and Hull.**—*J. Aust. Inst. agric. Sci.*, iv, 1, pp. 47–49, 1938.

A selective medium evolved by the author for the detection of bean [*Phaseolus vulgaris*] seed infection by *Bacterium medicaginis* var. *phaseolicola* [*R.A.M.*, xvi, pp. 150, 441, 728; xvii, p. 369] as well as for the isolation of the bacterium from soil and other sources, consists of

sodium taurocholate 15 gm., glycerol 30 gm., ammonium nitrate 10 gm., water 1,000 ml., gentian violet 0·02 (for a solid medium) to 0·2 gm. (for a liquid medium), and agar (for a solid medium) 15 to 17 gm. The seeds are placed in tubes or flasks containing the medium kept at about 25° C. After two days a loopful is transferred with a sterile needle to tubes of beef extract-peptone broth. After a further two days, inoculations are made from the broth tubes showing turbidity into pieces of fresh bean pods placed in Petri dishes. Pod infection in two to five days indicates that the seed is infected.

Certain bacterial saprophytes carried with the seed are able to grow in the selective medium and may prevent infection when the pod inoculations are made. Very light seed infection therefore is not always revealed by this method, which will, however, detect it when the direct inoculation of 6- to 24-hour-old water infusions of bean seeds into pods fails to do so.

WILSON (R. D.). **Occurrence of Bacterium syringae (Van Hall) E. F. Smith on French Beans (Phaseolus vulgaris L.) in New South Wales.**—*J. Aust. Inst. agric. Sci.*, iv, 1, pp. 42–43, 1 fig., 1938.

In 1936 and 1937 isolations from leaves of French beans (*Phaseolus vulgaris*) collected from several localities in New South Wales yielded an organism the cultural, biochemical, and physiological characters of which agreed generally with those of *Bacterium* [*Pseudomonas*] *syringae* [*R.A.M.*, ix, p. 695; xiv, p. 16; xv, p. 678; xvi, pp. 157, 329], while all the isolates fermented raffinose as rapidly as did cultures of *P. syringae* from citrus.

The affected leaves bore reddish-brown lesions with very little yellowing of the surrounding tissue, and the symptoms could not be confused with those of halo spot (*Bacterium medicaginis* var. *phaseolicola*) [see preceding abstract] except under dry conditions. Affected pods were noted in one crop, the lesions in this case being brown, sunken, rather less than 5 mm. in diameter, and closely similar to lesions resulting from needle-puncture inoculations of pods with pure cultures of *P. syringae*.

All the isolates made abundant white growth on beef extract-peptone agar slopes, produced a brown, sunken, necrotic lesion when inoculated with needle-pricks into French bean pods, and were pathogenic when needle-puncture inoculations were made in the stems of young French bean, cowpea, and snake bean (*Vigna sesquipedalis*) seedlings. When young seedlings of Tweed Wonder and Red Kidney beans were inoculated with any of the isolates by needle-puncture of the stem at the cotyledon node the plants wilted and generally collapsed above the point of inoculation in two to four days. Cultures reisolated from the inoculated plants were identical with the original isolates.

LORING (H. S.), OSBORN (H. T.), & WYCKOFF (R. W. G.). **Ultracentrifugal isolation of high molecular weight proteins from Broad Bean and Pea plants.**—*Proc. Soc. exp. Biol., N.Y.*, xxxviii, 2, pp. 239–241, 1938.

When the juice from *Vicia faba* plants infected with pea mosaic (pea virus 1) [*R.A.M.*, xvii, p. 91] was ultracentrifuged [cf. ibid., xvii,

p. 207] in a field of 40,000 g. for $1\frac{1}{2}$ hours, appreciable amounts of heavy material were obtained, the pellets being two or three times as large as those found in the latent mosaic virus. After three ultracentrifugations, a solution of the pellets in water gave the usual qualitative tests for protein and the kind of absorption diagram in the analytical ultracentrifuge that is typical of purified heavy proteins. Almost all the light 'unsedimentable' proteins were eliminated, and sharp boundaries were noted, characterized by the sedimentation constants $S_{20} = 76 \times 10^{-3}$ cm. sec^{-1} $dynes^{-1}$ and $S_{20} = 112 \times 10^{-13}$. Some samples gave a third boundary with $S_{20} = 54 \times 10^{-13}$.

The results of inoculation trials demonstrated some concentration of the virus in the sedimented pellets. The low specific activity of the sedimented protein indicated that it was not a pure virus protein, which was confirmed when ultracentrifugation of the juice from healthy broad bean yielded a similar non-infectious heavy protein with sedimentation constants similar to those from the infectious solution. Thus, either the concentration of the virus principle in the final solutions was too low to permit detection with the analytical ultracentrifuge, or else the virus had the same sedimentation constant as one of the normal constituents.

A purified protein, probably a nucleoprotein, giving sharp boundaries with $S_{20} = 77 \times 10^{-13}$, $S_{20} = 117 \times 10^{-13}$, and sometimes $S_{20} = 54 \times 10^{-13}$ was obtained from the juice of healthy peas (*Pisum sativum* var. *arvense*). Both the broad bean and pea proteins were pigmented (dark and light green, respectively) and of limited stability.

Similar procedures did not give homogeneous macromolecules from the juice of healthy tobacco plants; if such proteins exist, they are either very unstable or present only in very small amounts.

HASHIOKA (Y.). **The mode of infection by Sphaerotheca fuliginea (Schlecht.) Poll. in susceptible, resistant and immune plants.**—*Trans. nat. Hist. Soc. Formosa*, xxviii, pp. 47–60, 3 figs., 1938.

Continuing his studies on cucurbit wilt in Japan, the author carried out a series of experiments to determine the mode of penetration of the causal organism, *Sphaerotheca* [*humuli* var.] *fuliginea* [*R.A.M.*, xvii, p. 93], into susceptible, resistant, and immune plants.

The test plants of the first-named category were cucumber, watermelon, *Cucurbita melo* var. *conomon* f. *albus*, and *C. moschata* var. *toonas*. On cucumber cotyledons the germ-tubes arising from the conidia of the fungus usually attain a length of 20 to 40 μ within 15 hours, and about 5 hours later an infection hypha enters the host through the cell membrane of the epidermis. During its passage through the cellulose layer the infection hypha becomes enveloped in a papillate local thickening (Corner's 'infection papilla') [ibid., xiv, p. 711] directed towards the interior and giving rise on maturity to a slender hypha which continues to develop in the host cytoplasm, producing an absorbing vesicle at the apex. This vesicle gradually assumes an elongated-ellipsoid form and attains dimensions of 9 to 16 by 5·5 to 7·5 μ. At the same time the infection hypha extends to a length of 5 to 8·5 μ and forms the stalk of a haustorium. At this stage or a little later, a hyaline, very thin membrane, originating at the joint of the stalk, begins to encircle the vesicle, which is ultimately enclosed in a membranous sheath. At

maturity the haustoria are of an apple-like shape and measure 15 to 22 by 12 to 19 μ.

Beans (*Phaseolus vulgaris*), *Ricinus communis*, *Impatiens balsamina*, and *Petunia violacea* comprised the resistant group. Germ-tube development on the leaves of the two last-named (the most resistant) was somewhat less extensive than in the relatively more susceptible bean and *R. communis*. The plants of this group (except *P. violacea*) reacted to infection by a brown discoloration of the cells, which also involved the invading haustorium, while the sheath enveloping the haustorial vesicle in susceptible hosts is absent or poorly developed in resistant ones. In the case of the comparatively susceptible beans some of the haustoria are normally formed while others are disorganized; in *R. communis* haustorial production is scanty, the proportion of discoloration is high, and the presence of numerous infection papillae, up to 9 μ in length, serves to prevent the intrusion of infection hyphae into the host cytoplasm. Similar features are characteristic of *I. balsamina* and *P. violacea*.

The immune category falls into two sections, (1) subinfection and (2) negative infection, which in turn are subdivided into A and B. Section 1A, in which hyphal growth persists for a time, consisted of *Bryophyllum pinnatum*, *Emilia sonchifolia*, *Nicotiana glauca*, and *Ageratum conyzoides*. Conidial germinability was markedly restricted on these hosts with the exception of *B. pinnatum*, which also permitted approximately normal haustorial development, and reacted to invasion by swelling and discoloration of the cellular membrane and dissolution of the epidermal cells of the palisade parenchyma. These processes were followed by disorganization of the haustoria. In the other plants of this section the hyphae and haustoria are formed and disorganized similarly to the foregoing but do not persist as long in the infected tissues as in those of *B. pinnatum*. In the case of section 1B, represented by tomato, egg-plant, potato, and *Eichhornia crassipes*, the fungus dies immediately after the haustoria enter the host. On tomato the germ-tubes mostly attain a length of 25 to 40 μ and bear 1 or 2 infection papillae, but on the other hosts of this group only a single germ-tube, 30 to 40 μ in length, is produced, giving rise to one penetration hypha. All the plants show the characteristic browning and swelling of the cell walls at the site of penetration, but only in the case of tomato was cytoplasmic turbidity observed, due to the envelopment of the invading haustorium by a dark-coloured precipitate.

Section 2A comprises *Solanum nigrum*, tobacco, and broad bean (*Vicia faba*), in which penetration of the cell wall occurs but is not followed by the intrusion of the fungus into the cytoplasm. Conidial germination is fairly profuse and each germ-tube forms from 1 to 3 infection papillae on the epidermal membrane of the host, after which the development of the parasite is arrested. *S. nigrum* and broad beans show a yellowish discoloration of the affected cells. In the case of section 2B, represented by *Agave americana* var. *variegata*, *Cinnamomum camphora*, *Ficus elastica*, *Hoya carnosa*, *Rhoeo discolor*, *Tradescantia virginiana*, and *Vanilla somai*, *Sphaerotheca* [*humuli* var.] *fuliginea* appears to be unable to penetrate the very thick cuticle of the leaves.

ALEXANDRI (A. V.). **La mosaïque des feuilles de Solanum melongena L. en Roumanie.** [Mosaic of *Solanum melongena* L. leaves in Rumania.]—Reprinted from 'Hommage au Professeur E. C. Teodoresco', Bucharest, 1937, 12 pp., 1 fig., 1937. [Received May, 1938.]

Eggplant mosaic [*R.A.M.*, xv, p. 386], first observed in Rumania in 1931, is stated to have become progressively more virulent since that date, causing 50 to 60 per cent. damage in the Ilfov Department in 1934 and being detected in glasshouse plants for the first time in 1936.

Infection originates on the basal leaves, mostly of mature plants, and advances upwards, all the foliage being involved 20 to 40 days after the appearance of the initial symptoms. Affected plants develop abnormally slowly and the leaves do not attain their proper size; they are covered, moreover, with the yellow, interveinal lesions typical of mosaic infection, which expand by 1·2 mm. daily both in length and breadth. The diseased foliage rapidly shrivels and drops.

The inoculation of healthy eggplants with the filtered expressed juice of infected plants by means of a syringe or by spraying gave positive results, while detached leaves reacted to the former method only.

The virus was inactivated by exposure to a temperature of 60° C. and to 64 per cent. alcohol at 96°, but not by dilution up to 1 : 1,000. Cross-inoculation experiments with the virus on a number of other Solanaceae, including potato, *Solanum nigrum*, *Datura petaloides*, *D. stramonium*, *Nicotiana silvestris*, tobacco, *N. fragrans*, and *N. sanderae*, gave positive results. The aphid *Phorodon* [*Myzus*] *persicae* is suspected of transmitting the disease, but experimental proof has not yet been obtained.

HASSEBRAUK (K.). **Über die Eignung und Bewertung von Kupferoxychlorid als Spargelrostbekämpfungsmittel sowie einige andere Beobachtungen zum Spargelrost.** [On the suitability and value of copper oxychloride as a means of controlling Asparagus rust and some other observations.]—*Gartenbauwiss.*, xii, 1, pp. 1–16, 5 graphs, 1938.

The results of field experiments, carried out from 1934 to 1937, showed that the effect of the copper oxychloride preparation Wacker's Kupferkalk in the control of asparagus rust [*Puccinia asparagi*: *R.A.M.*, xvii, p. 429] was, contrary to the results obtained by Hülsenberg [ibid., xiv, p. 489] and Bremer [ibid., xv, p. 627], too slight and too variable to allow this treatment to be recommended. Four years' field tests on the effect of manure on the susceptibility of asparagus to rust yielded negative results. That the female plants are more readily attacked by rust is explained in the author's view by their less bushy habit, it having been observed that thickly branched plants are less susceptible to infection, whereas the fact that late shoots are more strongly attacked than the early shoots of the same plant is attributed to their physiological difference.

PORTÈRES (R.) & LEGLEU (R.). **La 'rosette' de l'Arachide. Connaissances actuelles, relations avec la date des semis dans le pays**

du Baoulé-Nord, méthodes prophylactiques à appliquer. [Groundnut rosette. Present knowledge, relationship with the sowing date in the district of Baoulé-Nord, and prophylactic methods to be applied.]—*Ann. agric. Afr. occ.*, i, 3–4, pp. 332–355, 1 map, 1937. [Received June, 1938.]

After briefly reviewing earlier work on rosette disease of groundnuts [*R.A.M.*, xvi, p. 653; xvii, p. 208], the authors give figures illustrating its prevalence in the French Ivory Coast (district of Baoulé-Nord) and state that in one typical instance the disease caused a loss of weight of 81 per cent. in the yield of fresh pods, 64 per cent. in fresh forage, and 71 per cent. in total plant weight, the weight of the fresh pods being only one-third of that of the fresh forage, though in healthy plants it was two-thirds.

Clear evidence was obtained that infection occurred most rapidly in the latest-sown fields, and that the damage caused was greatest when the plants became diseased in the early stages of growth.

Four morphologically distinct types of rosette are found locally, viz., chlorotic rosette, green rosette, rosette type 3 [ibid., xii, p. 5; xv, p. 426], and clump [ibid., xi, pp. 93, 223]. The first is extremely common, the second moderately so, the third very rare, and the fourth is only provisionally regarded as a distinct type, observations indicating that it is due to infection occurring so early that none of the plant organs has time to develop normally.

In chlorotic mosaic (Hayes' type I), the chlorotic leaves are occasionally more succulent and less pliant than normal ones, and leaf-rolling is present only as a very slight convexity of the blade. In the creeping varieties, the rosettes of those branches that have at first an erect habit spread out horizontally. When the first symptoms become evident the tips of the affected branches rise slightly. Severely affected plants produce other branches near the centre which rapidly become arrested and show a rosette formation. These branches often develop symptoms closely resembling green rosette.

The only possible local vector appears to be *Aphis laburni*, which occurs in large numbers on all groundnuts.

The control measures recommended consist in sowing during the two months following the first rains (i.e., March and April for places in the latitude of Bouaké), or even earlier where suitable, curtailing the total sowing period as much as possible, avoiding the resowing of late-sown patches that have become infected, removing and burning every diseased plant up to flowering time but not afterwards (this being uneconomic), adopting cultural practices to expedite and increase growth, maintaining an uncultivated, clean border 7 to 8 m. wide between the edge of the field and any road or path in order to avoid disturbing insects, and developing immune varieties.

Rui (D.). **Relazione su prove di lotta antiperonosporica effetuate nel 1937.** [Report on the anti-*Peronospora* control experiments conducted in 1937.]—*Ric. sci. Progr. tec. Econ. naz.*, Ser. 2, ix, 3–4, pp. 100–106, 1938.

Details are given of the writer's experiments on the control of *Plasmopara viticola* on vines at the Conegliano (Italy) Viticultural Experiment

Station in 1937 with three new liquid preparations, viz., copper oxyfluosilicate, Prodotto D'Agostino, consisting of copper sulphate, sodium hydrosulphite, and lime or gelatine (L. D'Agostino, Reggio E.), and cuprital, a blend of copper, iron, aluminium, calcium, and sodium salts (Spec. Anticritt. Naz., Turin). Of these the last-named gave the best results, approximating to those obtained in comparative tests with Bordeaux mixture and permitting a saving of some 60 per cent. of copper; it is easy to prepare and adheres well. Prodotto D'Agostino merits further trial, but copper oxyfluosilicate was ineffective.

Beaumont (A.) & Staniland (L. N.). **Fourteenth Annual Report of the Department of Plant Pathology, Seale-Hayne Agricultural College, Newton Abbot, Devon, for the year ending September 30th, 1937.**—48 pp., 2 figs., 1938.

In this report, which is on the same lines as those for previous years [cf. *R.A.M.*, xvi, p. 514], it is stated that, taking the days in 1937 that had a minimum temperature of 50° F. or over and a relative humidity of not under 75 per cent. at Seale-Hayne, the only favourable date for potato blight [*Phytophthora infestans*] infection during the year was 23rd May. No disease followed, confirming previous experience that early favourable periods are not generally followed by outbreaks in Devon.

In notes on fungal diseases during the year it is stated that one case of wheat infection by *Cercosporella herpotrichoides* [ibid., xv, p. 433; xvi, p. 242] was observed. White root rot (*Rosellinia necatrix*) of potatoes [ibid., viii, p. 628] was noted for the first time in Devon. Red core of strawberry [*Phytophthora* sp. allied to *P. cinnamomi*: ibid., xvii, p. 402] occurred at four centres in the Tamar valley, two of the cases being traced to infections during the previous year [ibid., xvi, p. 515]. A new disease of bulbous iris, apparently due to a species of *Phytophthora*, was found in Scilly by G. W. Gibson, causing greyish-white, later purplish-brown lesions on the leaves. The condition, which was first observed in 1928 on the variety Imperator, was also found by P. H. Gregory on White Excelsior at Penzance. It becomes noticeable only in very wet winters.

In a few localities anemones were affected by downy mildew (*Plasmopara pygmaea*), and in west Cornwall by a rotting of the corms and leaf-stalk bases caused by a strain of *Botrytis* sp. resembling *B. cinerea*. An irregular, yellow leaf-spotting caused by *Ramularia petuniae* destroyed a large part of the foliage of petunia pot plants under glass at Plymouth; the only previous record was in 1891, also at Plymouth.

Williams (P. H.), Ainsworth (G. C.), Oyler (Enid), White (H. L.), & Read (W. H.). **Plant diseases.**—*Rep. exp. Res. Sta. Cheshunt, 1937*, pp. 42–58, 1938.

The following are among the items of interest in this report, prepared on the usual lines [*R.A.M.*, xvi, p. 726], apart from those noticed from other sources. P. H. Williams investigated a more or less superficial browning of mushroom [*Psalliota* spp.] caps apparently identical with the 'wilt' attributed by F. C. Wood to *F. oxysporum* and *F. solani* var. *martii* [ibid., xvi, p. 434], but though *Fusarium* and bacteria were

isolated, inoculation experiments were unsuccessful, and the trouble is tentatively ascribed to unfavourable conditions in the beds. *Hypomyces rosellus*, in its conidial stage *Dactylium dendroides* [ibid., xiv, p. 346; cf. xvii, p. 378] was detected, for the first time at the Station, in some of the material inspected during 1937. On the beds the fungus produces a white growth tinged with pink or purple, covering and destroying the growing mushrooms but apparently causing only gradual decay. The fungus is generally controllable by the elimination of infected material and casing soil, but in severe cases formaldehyde should be applied to the small, isolated clumps of diseased mushrooms.

Enid Oyler describes a widespread disease of chrysanthemums, due to a *Verticillium* with cultural characters reminiscent of *V. dahliae* [ibid., xiii, p. 444], which causes stunting of the plants, especially the tops, and wilting and chlorosis of the leaves from the stem base upwards. Infection may be unilateral and sometimes involves only half the leaf surface, in which case bright yellow blotches develop at the margins and spread inwards. The diseased leaves subsequently turn brown and hang down along the stem: at this stage the lesions may be differentiated from those due to eelworm [?*Aphelenchoides ritzema-bosi*] by the more diffuse appearance of the patches. A brown discoloration of the basal wood extends upwards into the branches. The fungus was isolated from the affected parts of the plants, but not from the roots. The *Verticillium* wilt, which appears towards the end of July and reaches a climax in October and November, attacks many varieties, including Ace, Balcombe Beauty, Golden Favourite, Liberty, Pink Consul, Rose Précoce, and White Favourite. Infection is spread through infected cuttings, so that suspected plants should be destroyed after flowering.

The same worker inoculated heath (*Erica hiemalis*) plants with *Phytophthora cinnamomi* [ibid., xvi, p. 465] and a second species identified by S. F. Ashby as *P. cactorum*, both of which were isolated from diseased specimens received at the Station in 1936. The former is the more virulent of the two species, giving positive results in 92 per cent. of the tests as compared with only 25 per cent. for the latter, but the symptoms produced by both were indistinguishable. *P. cactorum* further proved capable of infecting the following plants susceptible to *P. cinnamomi*: *Antirrhinum* [*majus*], beech, broad bean, *Calceolaria*, *Nicotiana glutinosa*, *Schizanthus*, and stock [*Matthiola*]; it is also capable of causing rot of apple, pear, and tomato fruits, carrot roots, and potato tubers; of inducing local symptoms in *Gloxinia*, tobacco, *Primula obconica*, *Solanum capsicastrum*, and strawberry; and of destroying peas, *Rhododendron ponticum*, and tomato seedlings. *Phytophthora cactorum* may be combated by the methods recommended against *P. cinnamomi* [ibid., xv, p. 656].

Enid Oyler also investigated a leaf spot of marguerites (*Chrysanthemum frutescens*) caused by *Ramularia bellunensis*, previously reported from Italy [ibid., viii, p. 723] but not hitherto known to occur on this host in England. The foliage was attacked at all stages of development and bore irregular, greyish-brown, later darkening spots originating on the under side at the leaf tips and along the margins. The lesions spread inwards towards the midrib until the whole leaf turned brown and shrivelled. Hyaline spores were produced in the centres of the spots on

both leaf surfaces, a substomatal stroma giving rise to fasciculate conidiophores. Pure cultures of the fungus, applied to healthy marguerite leaves on plants in damp, shaded places in February and March, induced typical leaf-spot symptoms, but negative results were obtained in tests carried out later in the year or on plants more favourably situated in respect of light and ventilation.

H. L. White, in the course of a survey of glasshouse bean [*Phaseolus vulgaris*] diseases in ten nurseries, observed three of economic importance, viz., halo blight (*B*[*acterium*] *medicaginis* [var. *phaseolicola*: ibid., xvi, p. 727; xvii, p. 218], foot rot (?*Fusarium solani* var. *martii*) [ibid., xvi, p. 727], and mosaic [ibid., xvii, p. 5], of which both the first- and last-named have been shown to be seed-borne.

Continuing his studies on virus diseases G. C. Ainsworth found that lettuce mosaic [ibid., xvii, p. 6] is also transmitted by means of the seed. In a test in which a total of 1,828 plants of the Trocadero, Feltham King, and Lobjoit's Dark Green Cos varieties were raised from infected seed, 101 (5·55 per cent.) developed slight stunting and a distinct mottling of the second or third foliage leaf. Healthy lettuce plants inoculated with the juice from these infected seedlings also contracted typical mosaic symptoms. Diseased seed would thus appear to constitute the main source of initial infection in lettuce plantings under glass, while aphids are concerned in the subsequent spread of the virus. The use of virus-free seed and careful examination of the seedlings before transplanting should serve to control lettuce mosaic in glasshouses, while in the field the incidence of infection may be reduced by early roguing of diseased plants and sowing at times when aphids are scarce and in situations unlikely to attract them. It has been established that the disorder occurring at Cheshunt is identical with that described by Ogilvie [loc. cit.] from the west of England.

Inoculation tests on White Burley tobacco and *Zinnia* [? *elegans*] confirmed Price's conclusion as to the close relationship of lily mosaic and cucumber virus 1 [ibid., xvi, p. 615], but for the present the retention of the former designation as a special strain is advocated. *Gaillardia* and *Polyanthus* plants from Scotland and Wales, respectively, also yielded a virus identical with cucumber virus 1, not hitherto recorded on the former host in Great Britain.

The presence of the virus of tobacco necrosis [ibid., xvi, p. 637] has been definitely established in the experimental greenhouse at the Station.

In tests against tomato leaf mould (*Cladosporium fulvum*) W. H. Read found that promising results were given by a mixture of red cuprous oxide and a standard oil emulsion spray in the proportion of $\frac{1}{4}$ oz.: 1 gall. Promise was also shown by a complex ammonium silicate containing copper [ibid., xvii, p. 541] and zinc in combination with an oil emulsion. Neither rose nor cucumber mildew (*Sphaerotheca pannosa* and *Erysiphe cichoracearum*, respectively) was as well controlled by the cuprous oxide as by a bouisol-petroleum oil mixture [ibid., xvi, p. 726]. *C. fulvum* and *S. pannosa* were also effectively combated by a blend of colloidal copper hydroxide and petroleum oil. Cuprous and zinc oxide dusts, thoroughly shaken up with tomato seeds, failed to protect the latter against damping-off caused by *Phytophthora cryptogea* [ibid., x, p. 413].

RASMUSSEN (L.). **Oversigt over Resultaterne of Landboforeningens Forsøgsvirksomhed paa Sjaelland 1937.** [Survey of results of the experimental work of the Agricultural Union in Zealand in 1937.]—*Beretn. Planteavl., Sjaelland, 1937*, pp. 231–292, 1938.

The following are among the items of interest in the section of this Danish report dealing with the control of plant diseases. A substantial reduction in the incidence of grey speck of oats and beets [*R.A.M.*, xv, p. 87; xvi, pp. 82, 596] was effected by the application to the soil of manganese sulphate at the rate of 50 kg. per hect. In experiments on wheat suffering from the same disorder manganese sulphate increased the grain and straw yields by 1·9 and 4·2 hectokg. per hect., respectively (average of two trials).

The potato yields from tubers treated with sanagran [see below, p. 586] and uspulun dusts and aretan solution [ibid., xvii, p. 481] against stem canker [*Corticium solani*: see below, p. 621] were 189, 163, and 197 hectokg. per hect. as compared with 167 for the untreated controls, the corresponding amounts of infection on the stems being 12, 10, 2, and 52, and on the tubers 47, 45, 38, and 64 per cent., respectively.

LEPIK (E.). **Phytopathologische Notizen 10.** [Phytopathological notes 10.]—*Bull. phytopath. Exp. Sta. Univ. Tartu* 43, pp. 213–225, 4 pl., 1938.

Pseudomonas [*Bacterium*] *tumefaciens* is stated to have been causing severe damage of late years in Estonian nurseries, especially among superior apple and pear varieties and grafts. *Neofabraea* [*Myxosporium*] *corticola* [*R.A.M.*, xv, p. 468] was observed at Dorpat for the first time in 1935 on apples and pears.

An organism resembling *Bact. sepedonicum* [ibid., xvi, p. 628] was found to be associated with a dry ring rot of potato tubers, first observed in Estonia in 1934; externally invisible in the early stages, it first becomes evident in the form of gradually developing, more or less extensive superficial cracking: even when the interior is completely rotted there are no conspicuous outward symptoms of the trouble except the extremely light weight of the tubers, and the concentration of the starch in the form of white, floury, dry nodules which rattle on shaking the potatoes. A layer of the cortex, 1 to 2 cm. in thickness, remains sound throughout the course of the disease. The repulsive odour of butyric acid, characteristic of ordinary wet rot, is absent from tubers affected by the new ring rot. Infection appears to originate in the vascular bundles. Among other organisms present in the diseased tissues were *Bacillus phytophthorus* [*Erwinia phytophthora*], *Fusarium* sp., and *Cladosporium herbarum*, the fungi at any rate being of secondary importance while the respective roles of the bacteria in the initiation of the disease are not yet clear. The Deodara variety is the most susceptible.

In the central and southern parts of the country the spring of 1934 was exceptionally early, following a mild winter, with the result that barberry and *Rhamnus cathartica* leaves, normally covered at this period with the aecidia of *Puccinia graminis* and *P. coronifera* [*P. lolii*], respectively, were rust-free, owing to the late germination of the teleutospores and the plants having developed with sufficient vigour to

withstand infection. In the autumn of the same year infective aecidia of *P. dispersa* [*P. secalina*] were still present on *Anchusa arvensis* and *A. officinalis* as late as 16th October, by which time the early-sown rye had germinated and was severely attacked by the rust.

Dry rot (*Merulius domesticus*) [*M. lacrymans*], occasionally in association with *M. minor* [ibid., xvii, p. 216] and *Poria vaporaria*, has been prevalent of recent years, 90 per cent. of the cases occurring in recently erected buildings.

Other new records include *Oidium euonymi-japonici* on *Euonymus japonica* [ibid., xii, p. 578], *Ascochyta beijerinckii* on plums, *A. fagopyri* on buckwheat, *Cercosporella brassicae* on turnips [ibid., xv, p. 467], *Cladosporium album* [*Erostrotheca multiformis*] on sweet peas [ibid., ix, p. 629], *C. cucumerinum* on cucumber [ibid., xvii, p. 370], *Fusarium conglutinans* var. *callistephi* and *Verticillium albo-atrum* on *Callistephus* sp. [ibid., xvii, pp. 247, 248], *Phyllosticta cannabis* on hemp [ibid., xvi, p. 749], and *P.* [*Pleosphaerulina*] *sojaecola* on soy-bean [ibid., xi, p. 88].

LUTHRA (J. C.). **India : some new diseases observed in the Punjab and mycological experiments in progress during the year 1937.**—*Int. Bull. Pl. Prot.*, xiii, 4, pp. 73–74, 1938.

The following are among the items of interest in this brief report on mycological observations and investigations in the Punjab in 1937. Serious damage to the *Colocasia* crop in many parts of the Kangra Valley was caused by *Phytophthora colocasiae* [*R.A.M.*, xvi, p. 301]. Citrus seedlings were attacked and sometimes killed by a species of *Phoma*. *Rhizoctonia* sp. was found on gram (*Cicer arietinum*) [ibid., ix, p. 10].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 4, pp. 207–210, 6 figs., 1938.

In these notes [cf. *R.A.M.*, xvii, p. 297] it is stated that satisfactory control of shot hole of stone fruits [*Clasterosporium carpophilum*: ibid., xvii, p. 256] in New South Wales may be obtained by spraying with Bordeaux mixture (6–4–40) combined with an efficient spreader twice a year at the end of leaf fall in autumn, and in spring when a trace of petal colour is apparent in the swollen blossom buds.

Sooty blotch of citrus fruits attributed to *Leptothyrium* sp. [ibid., xvi, p. 451] produced irregular, diffuse, black blotches on the rind, causing appreciable losses only in the warmer coastal districts. Almost absolute control was obtained by application of a single spray of Bordeaux mixture (6–6–80–$\frac{1}{2}$) or lime-sulphur (1 in 40) in April to May.

Leaf spot of *Gerbera* is mostly caused by *Cercospora* sp. or sometimes by *Septoria gerberae* [ibid., xvii, p. 294]. The *Cercospora* produces infected areas on the leaves varying in size from that of a pin's head to $\frac{1}{4}$ in. in diameter, merging into large brown necrotic areas in case of severe infection. The *Septoria* leaf spot is characterized by purplish-black blotches on the foliage, often resulting in death of several leaves on the plant. The use of seeds from clean plants only, planting in clean soil, and spraying both surfaces of the leaves with Bordeaux mixture (4–4–50) at the first appearance of the disease, and then at intervals of two or three weeks, are the measures recommended for

control. In the case of severely diseased plants all infected leaves should be removed and burnt before spraying.

WATERSTON (J. M.). **Report of the Plant Pathologist, 1937.**—*Rep. Bd Agric. Bermuda, 1937*, pp. 24–37, 1938.

An enormous loss of crop products in Bermuda as a result of unnecessary wastage is ascribed in this report [cf. *R.A.M.*, xvi, p. 796] chiefly to the lack of adequate cold storage facilities, owing to which the crops are harvested according to the arrival and departure of steamships and often not in their proper stage of maturity. Good grading and pre-cooling facilities are stated to be also absolutely essential for solving the present problem of wastage. The spread of fungous diseases in Bermuda is favoured by high relative humidity (average 77 per cent. for 1937), which is further increased by close planting intended to minimize wind damage. The following soil-borne fungi have been found to accumulate through absence of frost and lack of crop rotation: *Sclerotinia sclerotiorum* (ubiquitous) [ibid., xvii, p. 217], *Phytophthora infestans* on potato, *Septoria apii* on celery [ibid., xvii, pp. 289, 498], and *Peronospora destructor* [*P. schleideniana*; ibid., xvi, p. 651] on onions, which became very prevalent after heavy rain in April. *Fusarium* [*bulbigenum* var.] *lycopersici* commonly occurred on tomatoes [ibid., xvi, p. 797; xvii, p. 419] grown without rotation, and *Corticium rolfsii* [ibid., xvi, p. 515; xv, p. 401] and *C. vagum* [*C. solani*] were found during the summer on carrots and potatoes. The height of the water table was observed to affect the time of appearance of *Phytophthora infestans* on potatoes and *S. apii* on celery. *Sclerotinia sclerotiorum* is stated to be probably the most destructive fungus in Bermuda, causing serious crop losses both in the field and during storage, and occurring on 35 host plants, including celery, cabbage, cucumber, carrot, roselle [*Hibiscus sabdariffa*], lettuce, tomato, parsley, peas, Irish potato, and clover (*Trifolium hybridum*). *Lilium longiflorum* var. *eximium* is apparently the only crop of economic importance which is not attacked. Field observations on *S. sclerotiorum* again showed that the infection was transmitted by air and not through the soil. The apothecial stage of the fungus was found in nature from January to March, while from May to June the fungus disappeared completely and its place was taken by *C. rolfsii* and *C. solani*, which are responsible for both field and storage rots during the summer. Of 6,505 carrot plants examined during February an average of 28 per cent. was infected with *S. sclerotiorum*. In comparative tests weeded plots showed 30 per cent. leaf infection by the fungus, as compared with 51 per cent. in the unweeded plot and 14 per cent. in the unweeded plot which had received a top-dressing of sulphur at a rate of 5 lb. per sq. rod. These figures illustrate the importance of humidity and are considered alarming, as the tests were made during very dry weather, which was not favourable to the spread of the disease. In cold storage experiments, carefully graded carrots showed a range of 0 to 4 per cent. and an average of 1·1 per cent. infection with *S. sclerotiorum* per crate, while similar carrots packed by farm labour showed 1·5 to 20·9 per cent. and 8·5 per cent., respectively. The principal causes of depreciation of Bermuda celery lie in the wilting caused by undue exposure in the field and in the rots caused by *S. sclero-*

tiorum, *S. apii-graveolentis*, and *Bacillus carotovorus* [*Erwinia carotovora*]. The trimming of the green tops of celery in accordance with the present shipping regulations was observed to restrict the loss of water in the plant and to reduce the amount of *Septoria* blight.

The need for a scientific system of sylviculture in Bermuda is stressed particularly with regard to the depressed state of the Bermuda cedar (*Juniperus bermudiana*). The chief disease of the cedar [ibid., xvii, p. 361] was found to be caused by a fungus apparently identical with a form of *Polyporus carneus* Auct. Amer., although a culture isolated at Princes Risborough, England, was not found to be typical of this species. *Gymnosporangium bermudianum* [loc. cit.] forms small, rounded galls, which are deep red at first and then turn dark brown, on the twigs of the cedar, and eventually kills the portions of the twig distal to the point of infection. *Pestalozzia funerea*, a species of *Phomopsis*, and *Pitya cupressi* were isolated from blighted cedar foliage. Thinning, pruning, and the use of surgical methods are recommended against the diseases.

Other diseases of economic plants include *Stachylidium theobromae* causing cigar-end disease of Cavendish bananas [ibid., xvi, p. 110], recorded for the first time in the Colony; a species of *Phytophthora*, provisionally assigned to the *P. palmivora* group, was isolated from green fruits of the tomato varieties Marglobe, Pritchard, and Break o' Day, causing brown spots on the fruit, the tissue remaining quite firm; *Puccinia antirrhini* [ibid., xvii, p. 396], first noted on snapdragon [*Antirrhinum majus*] towards the end of April, when it was too late to do any real damage; and the new records *Lenzites sepiaria*, destructive to worked wood, and *Leptodermella opuntiae* from prickly pear (*Opuntia dillenii*) [ibid., xvii, p. 461]. Rosette of lilies [ibid., xvi, p. 797] was low in incidence and was kept well under control by roguing.

De Nardo (A.). **Appendix IV. Report on plant pathology.**—*Rep. Dep. Agric. Malta, 1936–37*, pp. lx–lxiii, 1938.

In this report [cf. *R.A.M.*, xv, p. 780] it is stated that during the period under review the following were among the most serious fruit-tree diseases in Malta: *Armillaria mellea*, which was very injurious in several localities, *Sphaerotheca pannosa* and *Exoascus* [*Taphrina*] *deformans* on peach and almond [ibid., xvi, p. 389 *et passim*], *Sclerotinia linhartiana* [ibid., vi, pp. 337, 430] causing severe injury to the service tree [*Pyrus aucuparia*], and *Venturia pirina*, which seriously damaged all pear varieties, especially late ones. Important damage resulted from gummosis of Amygdalaceae and citrus trees, and a canker of citrus trees [ibid., xiii, p. 81].

Edson (H. A.) & Wood (Jessie I.). **Diseases of plants in the United States in 1936.**—*Plant Dis. Reptr, Suppl.* 103, 244 pp., 12 graphs, 8 maps, 1938. [Mineographed.]

The estimates here presented in tabular form of the losses caused among cereal, vegetable, fruit, and miscellaneous crops by fungal, bacterial, virus, and physiological diseases in the United States in 1936 have been prepared on the usual lines [*R.A.M.*, xvi, p. 826].

Plant pathology and physiology.—*Rep. Tex. agric. Exp. Sta., 1936*, pp. 85–116, 1937. [Received June, 1938.]

In addition to work already noticed from other sources [*R.A.M.*, xvii, pp. 34, 316], the following items of interest occur in this report. In a field containing dying cotton, sclerotia of *Phymatotrichum omnivorum* [loc. cit.] were found beneath a sprouting elm stump at a depth of $5\frac{1}{2}$ ft., close to deep-seated root-rot lesions on the tap-root; 67 per cent. of these sclerotia germinated readily. Planting a barrier of three sorghum rows between an inoculated and an uninoculated cotton plot from 1932 to 1936 successfully prevented the spread of the root rot in each year. In 1933, 1934, and 1935 sulphur slabs 4 by 4 ft. and $1\frac{1}{2}$ in. thick were used as barriers and the results showed that neither cotton roots nor the strands of *P. omnivorum* were able to penetrate the slabs.

Two isolations from tomato referred to *Myrothecium*, one from a decayed spot on a fruit and the other from a stem canker, and *M. roridum* [ibid., xvi, p. 320], isolated from snapdragon [*Antirrhinum majus*], were inoculated into normal tomato plants and each produced entirely distinct symptoms. The three organisms also showed quite different characteristics when grown on nutrient agar. It is concluded that these two new isolations probably represent distinct species, especially since *M. roridum* is only weakly parasitic on tomato fruits.

A series of experiments on the effect of medicated wraps or dips in the control of storage rots of tomato showed that unoiled paper wraps impregnated with $1\frac{1}{2}$ per cent. copper salt plus 4 per cent. sulphur gave very effective control; iodized paper wraps covered by an outer wrap of moisture-proof cellophane (300 MT) were more effective than either of these alone; paper wraps impregnated with $1\frac{1}{2}$ per cent. copper salt with or without oil also gave good promise; and rolling tomatoes in dry wettable sulphur or cuprocide [see below, p. 608], or a combination of both, generally led to a decrease of decay.

Studies on *Diplodia* die-back of roses [cf. ibid., xvii, p. 113] indicated considerable differences in varietal susceptibility to the disease, Pierre S. Du Pont, Souvenir, Georges de Pernet, A. R. Briarclough, Governor Alfred E. Smith, and Luxembourg being highly susceptible, and Radiance, Étoile de Hollande, Edith Nellie Perkins, Lady Hillingdon, Antoine Rivoire, Johanna Hill, and Kaiserin A. Viktoria apparently resistant. *Diplodia* sp., *Phomopsis* sp., *Pestalozzia* sp., *Phoma* sp., and *Botrytis* sp. were isolated from infected plants. The disease was reproduced by a *Diplodia* obtained from rose canes in both field and laboratory inoculation experiments. Isolations from rose canes affected with die-back, stored in an open shed, made at irregular intervals during 1934 and 1935, yielded large percentages of *Diplodia*; during 1936 colonies of *Diplodia* developed on 26·5 per cent. of the material. In control tests spraying with 3–3–50 Bordeaux plus 5 lb. wettable sulphur or dusting with a mixture consisting of 10 parts 300-mesh Spider brand sulphur, 1 part cuprocide, and 1 part lead arsenate resulted in only a slight reduction in die-back; disbudding reduced die-back from 10·15 per cent. in the check plots to 1·21 per cent. in the pruned plots.

Monthly counting of spots on rose leaves infected with *Actinonema* [*Diplocarpon*] *rosae* [ibid., xvii, p. 459] showed that the highest per-

centage of infection occurred during January, February, May, June, October, November, and December, and the lowest during July, August, and September. Germination of spores collected from January to June ranged from 49 to 82 per cent., dropped to 19 per cent. during July, 3 per cent. in August, and 5 per cent. in September, rising again to 42 per cent. in October, 61 per cent. in November, and 81 per cent. in December. It is concluded that the viability of the spores of *D. rosae* is probably affected by weather conditions.

CARDOSO (J. G. A.). **Mozambique : parasites of cultivated plants observed in the province of Sul do Save.**—*Int. Bull. Pl. Prot.*, xii, 4, pp. 74–76, 1938.

A list is given of some well-known diseases of fungal, bacterial, physiological, or undetermined origin affecting cultivated crops in Mozambique.

SĂVULESCU (T.). **Biologische Studien über den Weizenbraunrost in Rumänien.** [Biological studies on the Wheat brown rust in Rumania.]—Reprinted from *Jubiläumfestschrift 'Grigore Antipa'*, 67 pp., 3 col. pl., 13 figs., 15 graphs, 1 map, Impr. nat., Bucharest, 1938.

In this report the author gives an account of his experiments and observations over several years to clarify certain biological aspects of the occurrence and development of wheat brown rust (*Puccinia triticina*) in Rumania, a few results of which have already been noticed from a recent publication [*R.A.M.*, xvii, p. 510]. Temperature is apparently the main factor in the successful infection of the wheat crops with uredospores; for biological race 13, which prevails in the country, the minimum temperature for germination of the uredospores was shown to be 2° to 3° C., the optimum 10° to 22°, and the maximum 30° to 32°, the corresponding temperatures for growth of the germ-tubes being 5° to 6°, 16° to 20°, and 31°. The longevity of the uredospores varies with the time of their formation and with the wheat variety on which they are produced; the most vigorous are those that develop in May at a temperature of 15° to 20°. The optimum temperature for virulence and infectivity does not agree with those for germination or growth of the spores. The development of teleutospores on wheat is not directly determined by climatic conditions, but by the advanced stage of development of the host; they were found to retain their viability for two years. While *Thalictrum* was not found to be infected with brown rust in nature, successful infection was experimentally obtained with the teleutospores on *T. flavum*, *T. aquilegifolium*, *T. bauhini*, and *T. minus*, on the first-named of which well-developed aecidia were produced. The results of inoculation experiments with race 13 on a number of pure wheat lines grown in Rumania showed that the variety American 17 is physiologically immune from the rust, while American 15 and 26 proved to be markedly resistant in the field owing to certain anatomical and morphological peculiarities, and Sandu-Aldea 70 exhibited a high degree of tolerance to the fungus. As a class, summer wheats are more severely attacked than winter wheats. The results of further studies indicated that the greatest resistance to brown rust was exhibited by varieties with small, narrow leaves, and by those

with a thin haulm, in which the epidermis, cuticle, assimilating tissue, and sclerenchyma are poorly developed. It was also found that, in general, varieties with high osmotic pressure were the most resistant, and those with low osmotic pressure were the most susceptible, but this point needs further investigation, in view of the behaviour of certain pure lines which showed considerable variation from this general rule.

KOSTOFF (D.). **Triticum timococcum, the most immune Wheat experimentally produced.**—*Chron. bot.*, iv, 3, pp. 213–214, 1938.

In wheat-breeding work against fungal diseases [*R.A.M.*, xv, p. 352] the most promising resistant segregates obtained by the author recently were derived from the composite crosses (*Triticum dicoccum* × *T. monococcum*) × *T. vulgare* and (*T. compactum* × *T. timopheevi*) × *T. vulgare*. The author also produced the amphidiploid form *T. timopheevi-monococcum* ($n = 21$, $2n = 42$) after chromosome duplication in the F_1 hybrid, the chromosome number of this amphidiploid, named *T. timococcum*, being the same as that of *T. vulgare*. *T. timococcum* combines the disease immunity of *T. timopheevi* and *T. monococcum*. It also has larger grains than the parents. In the summer of 1937 it was grown at Moscow among the world collection of wheats, most of which became affected by rusts [*Puccinia* spp.], bunt [*Tilletia caries* and *T. foetens*], and mildew [*Erysiphe graminis*], though *T. timococcum* remained entirely unaffected. Artificial inoculations of this wheat with various rusts were unsuccessful. Of all the wheats known at the present time *T. timococcum* approaches most nearly to complete immunity from all diseases, and is the most promising form for breeding immune varieties.

GARRETT (S. D.). **Take-all or whiteheads disease of Wheat and Barley and its control.**—*J. R. agric. Soc.*, xcviii, pp. 24–34, 1937.

Take-all of wheat due to *Ophiobolus graminis* [*R.A.M.*, xvii, p. 448] is reported to have increased in England during the last few years, the most serious outbreaks having occurred on the lighter chalk soils of Wiltshire, Hampshire, Cambridgeshire, Norfolk, and Yorkshire, especially in 1935 and 1937, possibly favoured by the mild winters. The author describes the life-cycle and the development of the fungus in the field and discusses measures of control. In conditions favourable to the fungus, it may survive a full year, but in unfavourable circumstances not more than a few months. Thus, on heavy soils it may be safe to grow wheat after a slightly diseased crop of wheat provided that ploughing has been done early and drilling late, and that adequate organic manure has been applied, but on light soils it is dangerous. An interval of at least three months should be allowed between ploughing-under the diseased stubble and planting another cereal crop. On light soils the depth of cultivation should be reduced and the soil compacted by repeatedly rolling the crop in spring; on the heavier soils loose and cloddy seed beds and the ploughing-in of long straw which is liable to open the soil should be avoided. Manuring is advocated as a means of indirect control by improving the general condition of the plant, and superphosphate is stated to have a controlling effect on the disease by promoting vigorous root development.

IKATA (S.) & KAWAI (I.). **Studies in the stripe disease of Wheat.**—*Bull. agric. Exp. Sta. Okayamaken*, Extra No., 111 pp., 12 pl., 1937. [Japanese. Abs. in *Jap. J. Bot.*, ix, 2, p. (40), 1938.]

Cephalosporium gramineum infects wheat plants in Japan [*R.A.M.*, xiii, p. 623] through the roots, the vessels of which become filled with the mycelium and conidia of the fungus. The filtrate from nutrient solutions on which the organism has grown contains a toxin inhibiting seedling growth. The conidia are destroyed by 20 to 40 days' exposure to water at 29° to 39·5° C., so that they are unlikely to survive the summer in marshy localities but may well persist in dry sites. The minimum, optimum, and maximum temperatures for growth and conidial germination were found to be about 5°, 20°, and 30°, respectively. Under humid conditions *C. gramineum* succumbs within 96, 12, and 2 hours, 1 hour, and 5 minutes, respectively, to temperatures of 40°, 45°, 50°, 55°, and 60°, whereas in a dry state it may remain alive for 30 minutes at 80°. It was found to withstand six hours' exposure to — 20°. Mercuric chloride at concentrations of 1 in 3,000 and 1 in 500 destroyed the fungus in 40 and 5 minutes, respectively.

D'OLIVEIRA (B.). **Brown rust of wild species of Hordeum.**—*Rev. agron., Lisboa*, xxv, 3, pp. 230–234, 1937. [Received July, 1938.]

The problem of differentiation between *Puccinia anomala* and *P. hordei* Fckl on wild barleys [*R.A.M.*, xv, p. 209] presents considerable difficulties. Such differences as have been described by various authors are believed to rest on a confusion between *P. glumarum* and *P. anomala*, which commonly occur together on wild *Hordeum* spp. but are readily distinguishable by close observation and cultural studies. An attempt was made to determine whether *P. hordei* should be regarded as a distinct species, or merely as a physiologic race of *P. anomala* [ibid., xvii, p. 231] by ascertaining the host ranges of the two rusts by comparative inoculation experiments with five cultures of the brown rust, of which Nos. 1, 3, and 5 originated at Cambridge on *H. murinum*, *H. maritimum*, and *H. secalinum*, respectively, while 2 and 4 were collected at Lisbon, the former on *H. murinum* and the latter on *H. maritimum*.

The results of the cross-inoculation trials [which are tabulated] showed that the cultures, with the partial exception of No. 2, are narrowly confined to their original host species. None produced pustules on the cultivated barleys (Spratt Archer and Hey's differential hosts for *P. anomala*) used in the tests. In this respect the wild barley cultures deviate markedly from the physiologic races found on cultivated varieties, but such a difference does not, in the writer's opinion, entitle them to specific rank as *P. hordei* but merely denotes a high degree of physiologic specialization in *P. anomala*.

OLSEN (H. K.). **Forsøg og Undersøgelser vedrørende kemiske Midler til Bekæmpelse af Plantesygdomme og Ukrudt.** [Experiments and investigations concerning chemical preparations for the control of plant diseases and weeds.]—*Beretn. Planteavl., Sjaelland, 1937*, pp. 208–219, 1938.

Stripe disease of barley [*Helminthosporium gramineum*], which oc-

curred in 40 per cent. of the fields inspected, was effectively combated in eight years' experiments (1930 to 1937, inclusive) in various localities of Zealand, Denmark, by all the six disinfectants tested, viz., dahmit, sanagran, dansk tillantin [= ceresan-nassbeize], abavit-neu, and tillantin 1875 [= ceresan U.T. 1875: *R.A.M.*, xvii, p. 90], the average incidence of infection in the treated lots being 0·2 per cent. for the first-named and 0·1 per cent. for the five others compared with 6·2 per cent. for the untreated controls.

The average annual increases over the 7-year period in the yields of barley and oats treated against stripe disease and loose smut [*Ustilago avenae*], respectively, by these preparations are estimated at 231 and 167 kg. per hect., respectively.

Loose smut [*U. nuda*] was entirely eliminated from Kenya barley in three years' experiments by immersion in hot water at 51° C., with or without the addition of 1·5 per cent. dahmit or 0·75 per cent. tillantin, but the treatments caused average reduction of grain yield of 51 and 32 kg. per hect., respectively. The disease was present in 86 out of 87 fields examined, in only four of which, however, did the incidence of infection exceed 1 per cent.

WECK (R.). **Flugbrandbekämpfung bei Wintergerste in Eckendorf.** [Control of loose smut of Winter Barley at Eckendorf.]—*Pflanzenbau*, xiv, 10, pp. 369–378, 1938.

An outline is given of the progress gradually accomplished in Germany in the control of loose smut of barley [*Ustilago nuda*: *R.A.M.*, xvii, pp. 514, 516], with special reference to a system now in use on the estate of Eckendorf-Hovedissen for the combined elimination of this fungus and stripe [*Helminthosporium gramineum*]. So successful has the method proved that the two diseases in question are stated to be regarded as curiosities in the neighbourhood. The standard procedure is as follows. The seed-grain, in sacks with a 62·5 kg. capacity, is immersed for two hours in water heated to 45° C. with the addition of 0·075 to 0·1 per cent. ceresan, left for a further six minutes in the same solution tepid or cold, subjected to a preliminary 'cool' drying on Weka Progress driers at 30°, left overnight, given a second thorough drying on Neuhaus clay slabs at 45°, followed by cooling by passage through a narrow-mesh cleansing apparatus, and stored in the granary for several days, during which the heaps should be turned over two or three times. The addition of a fungicide counteracts the well-known depressing action of hot water alone on the germination of the seed-grain. Germisan (0·1 per cent.) was also moderately effective in this respect, though less so than ceresan.

FAWCETT (H. S.) & BITANCOURT (A. A.). **Relatorio sobre as doenças dos Citrus nos Estados de Pernambuco, Bahia, São Paulo e Rio Grande do Sul.** [Report on Citrus diseases in the States of Pernambuco, Bahia, São Paulo, and Rio Grande do Sul.]—*Rodriguésia*, iii, 10, pp. 213–236, 1937. [Received June, 1938.]

In this second report [*R.A.M.*, xvi, p. 603] the authors give notes on, and recommendations for the control of, the citrus diseases which Fawcett observed during his visit in 1936 in the Brazilian States of

Pernambuco, Bahia, São Paulo, and Rio Grande do Sul. In Pernambuco the more important diseases appeared to be foot rot (*Phytophthora* sp.), psorosis, and possibly also zonate chlorosis and melanosis [*Diaporthe citri*: loc. cit.]. A foot rot of citrus trees was observed in one locality, isolations from which yielded *Macrophomina phaseoli*, and further investigations are in progress to test the part played by this organism. In the same locality nursery sour orange trees showed a condition termed chrysosis, characterized by yellow or golden spots on the leaves resembling those of ring spot, and possibly due to a virus; it was particularly prevalent on trees abundantly infested by red spiders. The most important diseases in Bahia are foot rot (*P.* sp.), psorosis, and possibly zonate chlorosis. In one nursery a destructive root rot of young sour orange trees was found to be associated with *M. phaseoli*. In São Paulo the chief diseases are stated to be foot rot, psorosis, leprosis, melanosis, sweet orange scab [*Elsinoe australis*: loc. cit.], sour orange scab [*E. fawcetti*: loc. cit.], and in Rio Grande do Sul sweet orange scab, melanosis, foot rot, and possibly zonate chlorosis. An annotated list is also given of the less serious diseases in the various States, in all of which, except Pernambuco, a copious entomogenous fungous flora was observed, effecting a large measure of natural control of the scale insects on citrus trees.

Nuksan spots on Oranges.—*Palest. Gaz.* 776, *Agric. Suppl.* 28, pp. 95–97, 1938.

Oranges in Palestine are liable to be disfigured by two types of brown pitting, known locally as shallow and deep 'nuksans' [nooksans: *R.A.M.*, xiv, p. 31; xvi, p. 21]. In the former type there is depression of the flavedo involving the oil glands and the interglandular tissue; the spots are irregular in size and shape, appear on different parts of the fruit, may coalesce into large blemishes, and at first show no discoloration, but later turn yellowish to dull violet or dark brown. In advanced stages the oil glands sink deeper than the surrounding interglandular tissue. This shallow type of blemish is particularly common in rainy years, especially early in the picking season, and is usually found in groves on sandy, clay, or calcareous soil. The trouble is probably due to adverse climatic and soil factors. Severely affected fruit should not be exported. Control consists in applications of organic manures, improved drainage, and deferring picking after rain until the fruit has dried. Oleocellosis of lemons [ibid., xvii, p. 106] resembles shallow nuksans, but the oil glands remain prominent and the spots do not generally enlarge or turn brown.

In the form known as 'deep nuksans' there is a deep depression in the rind, including part of the albedo. The spot is generally round, $\frac{1}{4}$ to 1 cm. in diameter, watery-yellow, later brown, hard and dry or soft and wet, and with a marked point in the centre; the edges of the depressions are sharp and prominent. As the lesions are few and remain localized, they do not spoil the appearance of the fruit as much as shallow 'nuksans'. They are, however, liable to rot. This type of injury occurs as a rule late in the season and would appear to be due chiefly to external injury, leading to the break-down of the surrounding tissue. Affected fruit should not be exported. Control consists in protection from mechanical injuries by pruning and the use of wind-breaks.

West (E. S.). **Zinc-cured mottle leaf in Citrus induced by excess phosphate.**—*J. Coun. sci. industr. Res. Aust.*, xi, 2, pp. 182–184, 1938.

In the course of a fertilizer experiment with Navel and Valencia orange trees started in 1924 at the Commonwealth Research Station, Griffith, New South Wales, the trees receiving superphosphate developed a mottle leaf, typical of the well-known zinc-cured foliocellosis [*R.A.M.*, xvii, p. 389], while the other plots showed no such symptoms. It is concluded that the injury was due to zinc deficiency induced by phosphate, the excess of which caused the precipitation of the zinc absorbed by the plant. In the presence of phosphate, potash appeared to increase the foliocellosis slightly. Spraying with zinc sulphate gave 26 per cent. diseased trees as compared with 39 per cent. in the unsprayed check.

Winston (J. R.). **Algal fruit spot of Orange.**—*Phytopathology*, xxviii, 4, pp. 283–286, 2 figs., 1938.

In May, 1937, the writer first observed on the rind of Lue Gim Gong oranges from the Everglades, Florida, the dark brown to nearly black, slightly raised spots, averaging about 1 mm. in diameter, with irregular or acutely pointed margins, due to *Cephaleuros mycoidea* [*R.A.M.*, ix, p. 745], previous records of the alga in the State having been confined to the branches and leaves. The resulting penetration and discoloration seldom extended deeper than three or four cells into the flavedo, and there is no reason to suppose that the spotting contributed to the development of decay. The diseased fruit was produced on 7 to 9-year-old trees on drained saw grass [*Cladium germanicum*] muck land, bearing a profusion of weeds.

Rogers (C. H.) & Watkins (G. M.). **Strand formation in Phymatotrichum omnivorum.**—*Amer. J. Bot.*, xxv, 4, pp. 244–246, 11 figs., 1938.

The authors give an account of their studies of the formation of strands by *Phymatotrichum omnivorum* [*R.A.M.*, xvii, p. 456] on the roots of cotton plants, in pure cultures, and among hyphae developing from sclerotia. The results showed that under all these conditions the process is similar. The developing mycelium is composed of large hyphae, ranging in diameter from 15 to 40 μ, with septa at irregular intervals and repeatedly branching lateral hyphae of progressively smaller size. Some of the smaller hyphae make contact with the larger at irregular intervals and begin to grow over their surface, this process continuing until the central hypha is covered with a more or less compact pseudoparenchyma. Subsequent layers of cells are deposited in the same manner on the strand. Acicular hyphae are formed by the proliferation of certain cells in the outer layers of the strand and may reach considerable length, develop whorled branches, and begin to assume a transparent yellow or light-brown colour, presenting the aspect of more or less rigid spines. Various observations suggest that the compound hyphal structures are produced by the fungus when it approaches maturity, and that the strands are apparently not necessarily direct precursors of hyphal invasion of the host.

DRECHSLER (C.). **New Zoopagaceae capturing and consuming soil amoebae.**—*Mycologia*, xxx, 2, pp. 137–157, 4 pl., 1938.

The author describes [with Latin and English diagnoses] four further species of the Zoopagaceae [*R.A.M.*, xiv, p. 508; xvi, p. 634] subsisting by the capture of amoebae in the United States, considered to be new to science, namely: *Zoopage mitospora* occurring in leaf mould; *Z. thamnospira* in decaying tomato roots in a greenhouse; *Stylopage cephalote* in decaying spinach roots and in partly buried decaying leaves; and *Acaulopage acanthospora* in decaying plant remains. A full Latin diagnosis is also given of the family Zoopagaceae.

KILE (R. L.) & ENGMAN (M. F.). **Further studies of the relation of Pityrosporum ovale to seborrheic eczema.**—*Arch. Derm. Syph., Chicago*, xxxvii, 4, pp. 616–626, 5 figs., 1938.

In a further series of experiments at Washington University with *Pityrosporum ovale* [*R.A.M.*, xiv, p. 696], significant reactions frequently followed inoculation of the chest, while clinical seborrheic eczema of the scaly type was often reproduced by the introduction of whole cultures of the fungus into the intact skin of the scalp. Intradermal tests with pityrosporin provoked only mild reactions which could not be correlated either with the presence or absence of the disorder under investigation. *P. ovale* was detected in the scales of 21 out of 24 of the patients examined with blepharitis marginalis of the eyelids, and in nearly every case in the lashes as well.

BENEDEK (T.). **On a new species of the genus Microsporum, Microsporum stilliansi, Benedek, 1937, n. sp., with special consideration of the phenomenon of dissociation in fungi imperfecti.**—*J. trop. Med.* (*Hyg.*), xli, 7, pp. 114–118, 12 figs., 1938.

This is an exhaustive account of the writer's clinical, cultural, and morphological studies [with a Latin diagnosis] on *Microsporum stilliansi* n. sp., the agent of tinea capitis in three coloured brothers, aged 7, 10, and 14 years, at Chicago.

Giant cultures on beer wort agar presented after four weeks' growth certain remarkable features serving to differentiate the fungus from other known *M.* spp. The surface revealed a central conical elevation and configuration consisting of vermiform gyri. Sectoring was also observed, one dissociate (A) being white and powdery, and the other (B) chocolate-coloured and glabrous; no evidence of reversion to the parent type was detected through a dozen generations. On beer wort agar the simple or branched conidiophores of (A) measure 10 to 30 by 2 μ, the oval or round, sessile conidia 3·75 by 3·75 or 7·5 by 7·5 μ, those of the piriform pedunculate type 3·75 by 1·5 μ, and rare intercalary or terminal chlamydospores 3·75 by 3·75 μ. Spore formation in (B) is confined almost exclusively to hyaline to bright yellowish-brown chlamydospores, 7·5 by 5·6, 7·5 by 7·5, or 9·3 to 11·5 by 5·6 to 7·5 μ. Nodular organs and coremia are abundantly produced. On Conant's polished rice medium [*R.A.M.*, xvii, p. 174] (which proved extremely valuable for differential studies on this and other *M.* spp.), sessile or pedunculate conidia, 3·5 by 3·5 μ, were also formed by dissociate (B), while both (A) and (B) produced loosely coiled spiralled hyphae.

MÜLLER (H.), ESSED (W. F. R.), & HAZEBROECK (F. E. A.). **Ein Fall von Chromoblastomykose in Ost-Java.** [A case of chromoblastomycosis in East Java.]—*Geneesk. Tijdschr. Ned.-Ind., 1937*, pp. 3259–3268, 1937. [Dutch, with English summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lix, 5–6, p. 318, 1938.]

A description is given of a case of chromoblastomycosis caused by *Trichosporium* [*Hormodendrum*] *pedrosoi* [*R.A.M.*, xvi, p. 812 and next abstract] in East Java. Skin tests with fungal extracts yielded positive results.

POPOFF (I. S.), HEFT (B. B.), ANTIMONOVA (Mme Z. S.), & LITVINENKO (D. I.). **Fall von Chromoblastomykose.** [A case of chromoblastomycosis.]—*Vyestn. venerol. derm.*, xii, pp. 1170–1173, 1937. [Russian. Abs. in *Zbl. Haut- u. GeschlKr.*, lix, 7–8, p. 445, 1938.]

The fungus isolated from a case of chromoblastomycosis of the leg in a 35-year-old woman in the U.S.S.R. corresponded in the main with *Acrotheca* [*Hormodendrum*] *pedrosoi* [see preceding abstract], from which it differed chiefly in the production of conidia laterally as well as terminally.

TOBIAS (J. W.) & NIÑO (F. L.). **Estudio de una nueva observación de granuloma paracoccidioídico (forma linfático-visceral).** [A study of a new observation on paracoccidioidal granuloma (lymphatic-visceral form).]—*Prensa méd. argent.*, xxv, 5, pp. 232–243; 6, pp. 286–301, 67 figs., 2 graphs, 1938.

Paracoccidioides brasiliensis [*R.A.M.*, xvi, p. 461] was isolated in pure culture on Sabouraud's glucose agar from a fatal case of granuloma involving the lymphatic glands and viscera of a 35-year-old Pole in the Argentine. An intensive clinical study was made of the case, of which a full report is given.

POLANO (M. K.). **Een epidemie van Muizenfavus te 's-Gravenhage.** [An epidemic of Mouse favus at 's-Gravenhage.]—*Ned. Tijdschr. Geneesk.*, lxxxii (II), 18, pp. 2114–2115, 1 pl., 1938. [French, English, and German summaries.]

Details are given of an epidemic of mouse favus at a shoemaker's shop at 's-Gravenhage, Holland. *Achorion quinckeanum* [*R.A.M.*, xvi, p. 535] was isolated on Sabouraud's medium both from the diseased animals and from three human patients to whom infection was communicated.

FERRABOUC (L.), SOHIER (R.), HENRION (J.), & GOULÈNE (F.). **Mycose verruqueuse.** [Verrucose mycosis.]—*Bull. Soc. franç. Derm. Syph.*, xlv, 1, pp. 4–7, 2 figs., 1938.

Clinical details are given of a case of verrucose mycosis of the hands, due to *Trichophyton rubrum* [*R.A.M.*, xvii, p. 38 and next abstract], in a 32-year-old soldier in the colonial service, who had contracted the disease at Tonkin, Indo-China, ten years earlier.

GOUGEROT (H.), BURNIER [R.], & DUCHÉ [J.]. **Polyépidermomycose disséminée due à Epidermophyton inguinale et à Epidermophyton rubrum.** [Disseminated polyepidermomycosis due to *Epidermophyton inguinale* and *Epidermophyton rubrum*.]—*Bull. Soc. franç. Derm. Syph.*, xlv, 1, pp. 29–30, 1938.

Two fungi were simultaneously isolated in pure culture on Sabouraud's test medium from a case of disseminated erythemato-squamous dermatosis in a 35-year-old naval mechanic recently returned to France from China, viz., *Epidermophyton* [*Trichophyton*] *rubrum* [see preceding abstract] and *E. inguinale* [*E. floccosum*: *R.A.M.*, xvii, p. 321]. A third fungus *Malassezia furfur* [ibid., xvii, p. 529] was present in the brown scattered patches of pityriasis versicolor on the same patient.

DE GREGORIO (E.). **Nota previa al estudio de la flora dermatofítica en Zaragoza.** [Preliminary contribution to the study of the dermatophytic flora of Saragossa.]—*Act. dermo-sifilogr., Madr.*, xxix, 1, pp. 239–241, 1938.

The following organisms were isolated from a total of 108 cases of human and animal dermatomycoses in Saragossa, Spain: *Microsporon audouini* (16), *M. tardum* [*R.A.M.*, xvi, p. 458] (2), *M. lanosum* (3), *Trichophyton gypseum granulosum* [*T. mentagrophytes*: ibid., x, p. 243; xvii, pp. 176, 243, 245] (2), *T. cerebriforme* [ibid., xiv, p. 510; xv, pp. 218, 501] (1), two new species of *Trichophyton*, *T. faviforme album* [*T. album*] (25) [ibid., xvii, p. 321], *T. f. discoides* [*T. discoides*: ibid., xvii, p. 395] (23), *Achorion schoenleini* [ibid., xvii, p. 530] (3), and *Epidermophyton inguinale* [*E. floccosum*: see preceding abstract] (31). *M. audouini* was responsible for an epidemic of ringworm in four brothers. The 25 cases of infection due to *T. album* were found among calves from Asturias, while *T. discoides* developed in 23 persons as a sequel to anti-smallpox vaccination.

HARRIS (L. H.). **Molds as a cause of allergy.**—*Ohio St. med. J.*, xxxiv, 2, pp. 158–160, 1938.

Particulars are given of a number of cases (all in young people under 30 examined and treated by the author in Ohio) of respiratory allergy of the seasonal hay-fever and asthma types in which moulds, including *Alternaria* sp., *Aspergillus fumigatus*, *A. hortai* [*R.A.M.*, xii, p. 445], *Chaetomium*, *Hormodendrum*, *Mucor*, *Penicillium*, and *Trichoderma* spp., and *Monilia sitophila* [ibid., xvii, p. 243], acted as contributory factors.

PUNTONI (V.). **Studi sul genere 'Trichosporon Behrend'.** [Studies on the genus *Trichosporon* Behrend.]—*R. C. Accad. Lincei*, xxvi, 11, pp. 413–417, 1937. [Received May, 1938.]

After giving a summarized historical account of the genus *Trichosporon* since its creation in 1890 by Behrend, the author states that careful studies of arthro-blastosporous fungi have led him to concur entirely with Ota's views on the genus [*R.A.M.*, v, p. 363], which are also accepted by Nannizzi. Culturally the genus is characterized by the cerebroid aspect of cultures on agar media containing sugar, and the crateriform aspect of isolated colonies; by the formation of very

consistent pellicles on the surface of liquid sugar media; and by the moderate capacity of the organisms to break down protein but not sugars. Morphologically it is characterized by a mycelium with septate hyphae, 3 to 5 μ broad, tending rather to form lateral branches than to bifurcate; and by the production of arthrospores, blastospores, and intermediate forms, and also of chlamydospores and of occasional bodies resembling pseudoconidia. Pathologically, it includes pathogens of 'piedra', as well as of mycoses of the skin, mucous membranes, or internal organs. A tentative Latin diagnosis of the genus is appended. Thus based the genus then includes the following species: *T. beigeli*, *T. giganteum*, *T. granulosum*, *T. cutaneum* (culturally and morphologically almost identical with *T. beigeli*), *T. balzeri*, and *T. infestans* [ibid., xv, p. 96], on all of which brief notes are given, chiefly of cultural characters.

LINDEGG (GIOVANNA). **Note fitopatologiche. III. Antracnosi fogliare dell' Agave per 'Colletotrichum agaves' Cav.** [Phytopathological notes. III. Leaf anthracnose of Sisal due to *Colletotrichum agaves* Cav.]—*Riv. Pat. veg.*, xxviii, 3–4, pp. 75–79, 2 figs., 1938.

During spring the basal leaves of *Agave americana variegata* kept during winter in glasshouses in Italy very often wither, and circular or slightly elliptical, depressed, dark spots 1 to 2·5 cm. in diameter surrounded by a raised, dark ring develop on the margins and in the middle of the blade. These spots may become confluent and affect the entire surface of the leaf. The diseased areas showed the presence of a fungus identified as *Colletotrichum agaves* [*R.A.M.*, xvii, p. 322].

Prevention consists in spraying the plants before putting them away for the winter with a 1 per cent. cupric mixture to which a sticker has been added (50 g. casein per hectol., or 1 per cent. saponin) and giving a few further applications during winter of a cupric-sulphur dust. Removal of affected leaves and the same treatment will also control infection once it has started.

LYLE (E. W.) & MASSEY (L. M.). **Control of stem and graft canker of the Rose.**—*Amer. Rose Annu., 1938*, pp. 142–148, 1938.

Coniothyrium fuckelii [*Leptosphaeria coniothyrium*], the agent of stem and graft cankers on roses in the United States [*R.A.M.*, xvii, p. 459], has not proved amenable to direct control by fungicides, but excellent results have been obtained by careful pruning and the excision of the cankers at the node below the visibly diseased area. In grafting it is important to cut the scions so as to avoid leaving stubs above the nodes. Of 799 grafts with scions having less than $\frac{1}{4}$ in. stem above the leaf axil only 0·3 per cent. developed canker at the tops of the scions, whereas of 76 with more than $\frac{1}{4}$ in. 12 per cent. contracted infection. In a test where care was taken to cut close to the node, there was only 0·8 per cent. infection at the tops of the scions in 10,149 grafts on three varieties, and 1·7 per cent. at the union.

CHESTER (K. S.). **Cucumber mosaic in greenhouse Petunias.**—*Plant Dis. Reptr*, xxii, 5, pp. 81–82, 1938. [Mimeographed.]

In December, 1937, several hundred young potted *Petunia* trans-

plants in a greenhouse in Oklahoma showed almost 100 per cent. mosaic, the symptoms varying in severity but resembling those of tobacco mosaic and consisting of green mottling with conspicuous stunting. When young Turkish tobacco plants were inoculated with the virus no clearing of the veins occurred until the eleventh day. Sub-inoculations from these tobacco plants and inoculations from the affected *Petunia* plants to *Nicotiana glutinosa* produced a systemic disease, but not the local lesions characteristic of tobacco mosaic. Inoculations from the *Petunia* plants to young cowpeas produced the small, punctate, local necrotic lesions characteristic of cucumber mosaic. In view of all these facts, the *Petunia* virus is considered to be a strain of cucumber mosaic.

With reference to control, it is pointed out that whereas *Petunia* plants affected with tobacco mosaic would not be a danger to greenhouse cucurbits in the vicinity, the plants in question would.

Boischot (P.). **Le Jasmin.** [Jasmine.]—*Progr. agric. vitic.*, cix, 17, pp. 399–401, 1938.

The chief fungal disease of jasmine in France is root rot, caused by *Rosellinia aquila* and *R. necatrix* [*R.A.M.*, xiv, p. 62; xvi, p. 454] in association. Hitherto large doses of iron sulphate have been used as a preventive, but without much success. The author states that the disease can be reduced to the minimum by planting jasmine on a well-drained soil that contains no organic matter, such as decomposing trunks or roots or plant debris. *R. aquila* and *R. necatrix* occur abundantly in argillaceous soils which maintain a high water content in winter. The disease is not to be feared in the region of Pégomas (valley of the Siagne), where the soil is very permeable, but is very common in the vicinity of Grasse.

Stapp (C.). **Der bakterielle Erreger einer Blattfleckenkrankheit von Begonien und seine Verwandtschaft mit Pseudomonas campestris, dem Erreger der Adernschwärze des Kohls.** [The bacterial agent of a leaf spot disease of Begonias and its relationship with *Pseudomonas campestris*, the agent of vein-blackening of Cabbage.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxii, 3, pp. 379–397, 9 figs., 1938.

From begonia leaves from various parts of Germany affected by a disease similar to that previously reported from Denmark, Holland, and Germany [*R.A.M.*, xvi, p. 320], the writer isolated in pure culture on various nutrient media a motile, predominantly uni-, occasionally biflagellate, Gram-negative, non-acid-fast, rod-shaped cylindrical organism composed of both rough and smooth forms, producing on bouillon agar yellow, transparent, butyrous colonies reaching a diameter of 2 to 2·5 mm. in four days, liquefying gelatine, peptonizing milk, making moderate growth in Uschinsky's solution but none in Fermi's or Cohn's, utilizing glucose, saccharose, lactose, glycogen, amygdalin, asparagin, peptone, urea, A-alanin, leucin, tyrosin, and (less freely) other sources of carbon and nitrogen, vigorously hydrolysing starch, reducing nitrates slightly, and forming hydrogen sulphide in 10 per cent. peptone solution. The organism developed more profusely at the alkaline range and increased the alkalinity of media to an end point of P_H 8·6 to 9·35, but

failed to grow (except for one smooth strain) at 4·4. The minimum, optimum, and maximum temperatures for development were 1° to 5°, 28° to 30°, and 42° to 43° C. with a thermal death point between 49° and 50°. The constancy of the smooth and rough forms of the bacterium was not uniformly maintained in subcultures on bouillon agar, hence no undue importance should be assigned to the generally stronger pathogenicity of the rough strains in inoculation experiments [full details of which are given] on *Begonia alba* and Gloire de Lorraine, Konkurrent, and Baardze's Favourite varieties.

In morphological and physiological characters the begonia organism, originally designated by Buchwald in Denmark *Bact. begoniae* [ibid., xiii, p. 308], corresponds fairly closely with *Pseudomonas campestris*, the agent of black rot of cabbage, but there was no serological agreement between the two, and, moreover, *P. campestris* is not pathogenic to begonias, so that there is evidently no question of identity. It is accordingly proposed to name the begonia organism *Pseudomonas begoniae* (Buchwald) n. comb., of which *Phytomonas flava begoniae* Wieringa [ibid., xv, p. 229] and *Bact. flavozonatum* McCulloch [ibid., xvi, p. 613] are regarded as synonyms.

Fikry (A.). **Rust pustules on roots of Antirrhinum.**—*Ann. Bot., Lond.*, N.S., ii, 6, pp. 536–537, 1 fig., 1938.

Attention is drawn to the occurrence of teleutosori of *Puccinia antirrhini* on the root system of some *Antirrhinum* [*majus*] plants severely attacked by the rust in Egypt [*R.A.M.*, xvi, p. 387; xvii, p. 396].

Mains (E. B.). **Host specialization in Coleosporium solidaginis and C. campanulae.**—*Pap. Mich. Acad. Sci.*, xxiii, pp. 171–175, 1938.

Three years' experiments near Ann Arbor, Michigan, in which isolations of *Coleosporium solidaginis* [*R.A.M.*, xiv, p. 364] from *Solidago canadensis*, *Pinus resinosa*, and *Aster novae-angliae* were cross-inoculated on a large number of Compositae, indicate that this species consists of various physiological races. Species of *Aster* were not infected to any appreciable extent by the *Solidago* rust, and conversely species of *Solidago* were resistant to the *Aster* rust. The rust from *S. canadensis* and *P. resinosa* infected species of *Solidago*, but not all in the same manner. *S. ohioensis* and *S. rigida* were resistant to the rust from *S. canadensis* but very susceptible to that from *P. resinosa*. The results of inoculations of numerous species of *Campanula* with *Coleosporium campanulae* [ibid., xvii, p. 278] from *Campanula americana* did not completely agree with those obtained with any of the European specialized forms, and it is concluded that this rust is an additional specialized form. The variations observed in several of the species of *Campanula*, especially *C. rapunculoides*, seem to indicate that these plants are not necessarily genetically uniform for rust reaction. Apparently there exists in these two rusts as complicated a situation as in the cereal rusts. It is suggested that accurate comparisons of the reaction within a host species will only be possible when strains of host species genetically identical for rust reaction are employed in the investigations, although the possibility of the isolation and the maintenance of such

strains appears to be doubtful and could only be attempted where justified by the economic importance of a particular rust.

BUCHWALD (N. F.). **Berberis-Arternes Modtagelighed for Sortrust (Puccinia graminis).** [The susceptibility of *Berberis* species to black rust (*Puccinia graminis*).]—Reprinted from *Gartnertidende, 1937,* 5 pp., 2 figs., 1937. [Received July, 1938.]

The writer tabulates and discusses in the light of recent investigations the relative susceptibility to *Puccinia graminis* of a number of species of barberry occurring in Denmark (according to the catalogues of reputable nurseries and the Scandinavian horticultural lexicon). From these investigations it would appear that, in general, the evergreen varieties belonging to the sections *Buxifoliae, Ilicifoliae*, and *Wallichianae*, with their thick leaves of leathery consistency, are resistant, whereas the thin-leaved, deciduous species of the *Vulgares* section, including the familiar *Berberis vulgaris* and its var. *atropurpurea*, are highly susceptible. Absolute immunity from *P. graminis* appears to be a feature of *B. thunbergii* and its vars. *atropurpurea* and *minor* of the section *Sinensis* as well as of *B. concinna* (*Angulares*) and *B.* (*Mahonia*) *repens*; other representatives of *Sinensis*, however, e.g., *B. chinensis* and *B. canadensis*, are susceptible. *Mahoberberis neubertii*, a hybrid between *B. vulgaris* and *Mahonia* [*B.*] *aquifolium*, is also generally susceptible, but individual reaction varies, while *B. bealii* is only slightly attacked.

McWHORTER (F. P.). **The antithetic virus theory of Tulip-breaking.**—*Ann. appl. Biol.*, xxv, 2, pp. 254–270, 2 pl., 1938.

This is an account of four years' experiments to test the theory that tulip 'breaking' [*R.A.M.*, xvii, p. 459] results from the presence within the plant of two distinct and antithetic viruses, the colour-removing virus I and the colour-adding virus II, as first formulated by the author in 1931 [ibid., xii, p. 292]. Using the same inoculation method as in previous work with a mosaic of irises [ibid., xvi, p. 254] the author injected healthy tulip plants either with viruses from plants exhibiting full break (virus I), self break (virus II), or measured mixtures of the two. The symptoms produced by these injections, measured in terms of growth and colour response, confirmed the view that the viruses are antithetic, virus I being dominant. The commercial broken tulips are stated to represent responses to physiologically balanced mixtures of the two viruses. Some of the red varieties proved incapable of breaking white or full, apparently owing to the presence of a factor inhibiting the action of virus I.

CALDWELL (J.) & JAMES (A. L.). **An investigation into the 'stripe' disease of Narcissus. I. The nature and significance of the histological modifications following infection.**—*Ann. appl. Biol.*, xxv, 2, pp. 244–253, 2 pl., 2 diags., 1938.

The symptoms of the stripe disease of *Narcissus* [*R.A.M.*, xiv, p. 366; xvi, p. 728, and next abstract] are stated to vary so widely that doubt is expressed as to whether only one pathogen is involved. Discoloration of the foliage and flower stalks usually occurs, but both shape and

colour of the affected areas vary with different host varieties. There are two main types of discoloration, one ranging from slightly yellowish-green to bright yellow, occurring either as longitudinal stripes of variable length and width or as mottling, which frequently covers a large part of the leaf surface; the other type is silver-grey, in longitudinal stripes running along practically the entire length of the leaf; light streaks or patches appear in the flowers of some varieties. Longitudinal corrugations are formed on the surface of leaves of some varieties; they are very prominent in Czarina, while in other kinds they remain small and inconspicuous. Some of the 'trumpet' varieties, especially King Alfred [daffodils], become severely distorted and often bent through a wide angle; minor distortions of flower stalks and leaves are not uncommon. In the absence of any technique for artificial transmission of the disease the authors investigated the changes in the internal structure of diseased plants collected from bulb fields and gardens and found that all types of symptoms were produced, in all varieties examined, by three factors in varying degrees of relative intensity. These factors were (1) destruction of chlorophyll, causing discoloration, (2) a stimulus to cell division in the epidermal and palisade tissues of the leaf and the flower stalk, and (3) a stimulus to growth of individual cells in the same tissues. Although the causal agent of the stripe disease still remains unknown, the results of the investigations are suggestive of a virus complex consisting of at least three components, which are all present in a diseased plant, but are not uniformly distributed throughout the diseased tissues, while the different behaviour of individual cells gives the impression that they can exist separately. Large bodies resembling X-bodies have been found in the cells, lying close to the nucleus.

Van Slogteren (E.). **The transmission of virus diseases in Daffodils.**—*Chron. bot.*, iv, 3, p. 205, 1938.

Evidence has been obtained in Holland by De Bruyn Onhoter that yellow stripe or mosaic disease of daffodils [*Narcissus pseudo-narcissus*: see preceding abstract] is transmissible by grafting two bulbs together and also by introducing expressed sap of diseased foliage into healthy leaves, the inoculated plants developing typical symptoms the following season. Out of about 1,000 control plants of the stock used not one bulb has shown any symptom of disease, while in some of the experiments 50 per cent. of positive results were obtained. Most of the stock used in the experiments consisted of healthy daffodils of the Sir Watkin variety, kept under control for two years and proved free from any mosaic symptom. Typical disease followed infection with sap from diseased plants of the Sir Watkin, Croesus, van Sion, Krelage, and Talma varieties. The inoculations were made in the open field from 4th March to end of April, and on 2nd June, 1937; no positive result was obtained from inoculations made between 4th and 17th March or in June.

Ark (P. A.), Tompkins (C. M.), & Smith (R. E.). **A bacterial bud and stem rot of Rocket Larkspur.**—*Phytopathology*, xxviii, 4, pp. 281–283, 1938.

Apart from some minor cultural differences in the sugar utilization

and fermentation processes, the organism isolated from rocket larkspurs (*Delphinium ajacis*) suffering from bud and stem rot in California agrees with *Erwinia phytophthora* [*R.A.M.*, xvii, p. 44]. The disease, which is characterized by extensive foliar chlorosis, stem-blackening, general stunting, and rotting of the succulent tissues, was shown to be transmissible by aphids (*Macrosiphum solanifolii*) from infected to healthy plants in a limited number of tests. Inoculation experiments gave positive results on a number of *Delphinium* species, including *D. consolida* and varieties of various colours raised from seed, as well as on carrot roots and potato tubers. Ten minutes' immersion of the seed in water heated to between 50° and 55° C. gave effective control of the disease.

HENRY (A. W.), CLAY (S. B.), & FRYER (J. R.). **Organic mercury fungicides and disease resistance in the control of Slender Wheat Grass smut.**—*Canad. J. Res.*, Sect. C, xvi, 5, pp. 195–202, 1938.

In the course of the authors' field experiments on seed treatment with fungicidal dusts for the control of the smut disease of *Agropyron pauciflorum*, originally identified as *Ustilago bromivora*, and later included by Fischer in the composite species *U. bullata* [*R.A.M.*, xvii, p. 505], the disease was completely controlled by treating the naturally or artificially smutted seed with ethyl mercury phosphate (new improved ceresan), methyl mercury nitrate (leytosan), or methyl mercury phosphate (leytosan P.), with mercury equivalents of 3·8, 1·5, and 3 per cent., respectively, each applied at a rate of ½ oz. per bush. None of the treatments caused appreciable injury to the seed after storage for one year. Application at higher rates gave equally satisfactory control but decreased the percentage of emergence. Treatment with a 50 per cent. copper carbonate dust was not effective. Although satisfactory control has so far been obtained by the wet formaldehyde treatment, the authors recommend the dry dust treatment as more convenient, quicker, and more suitable for use in advance of seeding time. In resistance tests with seeds from several collections of wild plants of *A. pauciflorum* and of hybrids between *A. pauciflorum* and *A. subsecundum*, artificially inoculated with smut at Edmonton, a considerable proportion appeared to be immune or highly resistant, and may serve as parental material for breeding resistant or immune varieties. The variety Fyra, an improved variety of slender wheat grass developed at the University of Alberta, was found to be highly resistant to, but not immune from smut. Until immune varieties are developed and generally distributed the continuance of seed treatment is advocated.

TURNBULL (J.). **Fruit tree spraying in 1937.**—*J. Minist. Agric.*, xlv, 1, pp. 16–22, 1938.

During 1937 sprays with triple and quadruple nozzles were tried out on a number of farms, paying special attention to Bramley's and Lord Derby apples [cf. *R.A.M.*, xvi, p. 547], and the following conclusions drawn from the results. For bush trees and fruit bushes spraying with 2 ft. lances with double nozzles from a central plant or through portable pipes is recommended; for half-standard trees a 4 ft. or occasionally

a 6 ft. lance with a triple nozzle with a 15° bend and 4/64 in. disks is preferable, and for very large trees, requiring 350 to 400 gals. per acre of summer wash, a 4-nozzle head without a bend, on a lance not longer than 4 ft., is most suitable, given sufficient pressure. A mobile outfit can carry one or two lances with 3 or 4 nozzles each. In all cases nozzle pressures of 350 to 500 lb. and 200 to 250 lb. require 4/64 in. and 5/64 in. disks, respectively. Seven-hole swirl plates are needed for a long drive, but six-hole plates are better for close work. This type of spray is unsuitable in strong wind, when it fails to reach the tops of the trees.

McKay (R.). **Conidia from infected bud-scales and adjacent wood as a main source of primary infection with the Apple scab fungus Venturia inaequalis (Cooke) Wint.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxi, 54–59, pp. 623–640, 1 pl., 1938.

The author points out that two sources of infection have so far been held mainly responsible for primary infection of apple trees with apple scab (*Venturia inaequalis*) [*R.A.M.*, xvii, pp. 465, 533], viz., conidia from one-year-old wood, and ascospores from dead leaves of the previous season. In the course of his observations at Glasnevin in 1937, however, the disease was found to develop on several varieties of apple trees in the absence of both scabbed wood and dead leaves, infection from February onwards having been traced to diseased bud scales and the adjacent tissue. In January a microscopic examination of dormant buds of unsprayed Bismarck and Bramley's Seedling, both free from external evidence of infection, showed that 53 and 49 per cent. of the buds, respectively, contained viable scab mycelium in the scales and the woody tissue at their bases. Examination of 26 further varieties of apple trees revealed the presence of infected bud scales and bases, no scabbed wood being present in ten cases. Infected bud scales were found mainly on blossom, but also on foliage buds, the scab pustules developing usually on the outside of the bud scale, but occasionally also on the inner surface; in one instance a pustule was found on the pedicel of the blossom truss within the bud. Sporulation occurred naturally during the second week in February, but the majority of infected bud scales produced conidia from the middle of April to the end of June, though this activity could seldom be detected without the microscope. On the new buds the first infected scales were observed on the 3rd July, showing visible black lesions, and the last on the 29th September. The first infected foliage was found in May, 1937, on a tree severely attacked in the previous year, and many similar small groups of diseased leaves were later found on others, the infection being confined in all cases to the oldest leaves, and amounting to at least 50 per cent. of the whorl. The neighbouring foliage remained healthy and the infection arose principally in the region of the buds, which were found to possess infected bud scales. Very little spread of infection occurred from tree to tree. A distinct correlation was found to exist between the amount of scab in 1936 and the percentage of infected buds in the following winter, which in turn was directly related to the early appearance of the disease. For the successful control of apple scab two pre-blossom sprays are recommended for severely

scabbed trees, while one spray is considered sufficient for mild cases, and attention is drawn to the importance of controlling outbreaks of the disease late in the season, thus keeping the foliage healthy and preventing ascospore development as well as the infection of the bud scales.

NUSBAUM (C. J.) & KEITT (G. W.). **A cytological study of host-parasite relations of Venturia inaequalis on Apple leaves.**—*J. agric. Res.*, lxvi, 8, pp. 595–618, 3 pl., 4 figs., 1938.

This is a full report of the authors' cytological studies of the entry and development of *Venturia inaequalis* in the leaves of Fameuse, Yellow Transparent, and Missouri Pippin apples, inoculated with two monoconidial strains of the fungus, an abstract from which has already been noticed from another source [*R.A.M.*, xv, p. 513]. In addition to the information formerly given, it is stated that spore germination, formation of appressoria or functionally equivalent structures, and the direct penetration of the cuticle occurred in all cases, without being perceptibly influenced by the combinations of isolate (fungus strain) and apple variety. It was shown, however, that in suitable isolate-variety combinations the fungus, though confined to the subcuticular region, is able to derive its nourishment efficiently from the underlying host tissues, and to produce a wide range of pathological effects in them. It is further believed that the observed variation in host-parasite reaction is due partly to differences in the degree and partly to differences in the kind of phenomena concerned, and that the use of a wider range of biotypes of host and parasite would increase the range of this variation. In its mode of penetrating the cuticle, diversity of isolate-variety reactions, and ability to subsist many weeks in balanced relations with the host, *V. inaequalis* is considered to resemble many obligate parasites.

DOUD (L. J.) & MCCOWN (M.). **Effect of spray materials applied in the blossoming period upon set of fruit of Grimes and McIntosh Apples.**—*Hoosier Hort.*, xx, 3, pp. 38–41, 1938.

Significant reductions in the set of Grimes apple fruits [cf. *R.A.M.*, xiii, p. 450] were caused by atomizing the open blossoms of thinned clusters with 2–6–100 Bordeaux mixture at the Department of Horticulture, Purdue University, Indiana, in 1935 and 1936 (41 and 16·7 per cent. respectively), but in 1937 no adverse effects followed the application by a power sprayer (400 lb. pressure) of the same preparation or wettable sulphur (6 lb. in 100 gals.) to unthinned clusters of Grimes and McIntosh. Russeting did not develop on the fruit treated with either fungicide. It is concluded that the value of these treatments in the control of fireblight [*Erwinia amylovora*] and scab [*Venturia inaequalis*] outweighs any crop reduction likely to result from spraying. [An account of this work also appears in *Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 36–38, 1938.]

KADOW (K. J.) & ANDERSON (H. W.). **The value of new copper sprays as fungicides for the control of Apple blotch, Cherry leaf spot, and Apple scab—1937.**—*Phytopathology*, xxviii, 4, pp. 247–257, 2 figs., 1 graph, 1938.

A detailed, tabulated account is given of experiments on the control

of apple blotch (*Phyllosticta solitaria*) [*R.A.M.*, xiii, p. 450], cherry leaf spot (*Coccomyces hiemalis*) [ibid., xvii, p. 328], and apple scab (*Venturia inaequalis*) by the application of some new copper-containing fungicides in Illinois in 1937, when ideal conditions obtained both for the development of the diseases under observation and for spray injury by water-soluble chemicals.

Blotch on Duchess apples was satisfactorily combated without spray injury by the following preparations (concentrations in 100 gals.): Bordeaux '34' (General Chemical Co.) 2 lb., with $\frac{3}{4}$ lb. each of zinc sulphate and lime, oxo-Bordeaux [ibid., xvi, p. 544] (Ansbacher-Siegle Corp.) 6 lb., copper zeolite [ibid., xvi, p. 764] 3 lb., and copper hydro 40 (copper hydroxide) [ibid., xvii, p. 541] from the Chipman Chemical Co. Cupro-K (copper oxychloride) from Röhm and Haas is recommended for further testing at 3 lb., since the 4 lb. concentration represented the borderline of safety, causing slight specking of the fruit. Further consideration should also be paid to copper phosphate (4 lb.) [ibid., xvii, p. 401] plus lime (6 to 8 lb.) and bentonite (4 lb.), which controlled all phases of blotch, except on the petioles, at half the above strength without injuring the trees or fruit. Other materials controlling blotch but damaging either the foliage or fruit, or both, were cuprocide 54 (containing cuprous oxide) from Röhm and Haas [ibid., xvii, p. 219], basi cop (basic copper sulphate) from the Sherwin-Williams Co. [ibid., xvii, p. 502], Bordeaux mixture, 'special copper' supplied by the Niagara Sprayer and Chemical Co., and coposil [ibid., xvii, p. 447 *et passim*], consisting of copper calcium and copper zinc silicates [cf. ibid., xiv, p. 591] from the Californian Spray Chemical Co.

Cherry leaf spot on the Montmorency, Early Richmond, and Dyehouse varieties proved less amenable than apple blotch to control by the test preparations, possibly on account of the lower concentrations of the latter recommended by the proprietors and the fewer applications given. The most promising results were secured with Bordeaux '34' ($1\frac{1}{2}$ lb.) plus zinc sulphate and lime ($\frac{1}{2}$ lb. each), cupro-K (2 lb.), and liquid lime-sulphur (2 gals.). Copper hydro 40, coposil, basi cop, and the Niagara special copper also gave good control, but the risk of injury to the trees must be minimized before they can be taken into general use.

All the above-mentioned copper preparations gave good control of apple scab, but their inclusion in the spray schedule cannot be advocated on account of the injury likely to be inflicted on such varieties as Jonathan, Winesap, Ben Davis, and Delicious under local conditions.

[A report of these experiments by H. W. Anderson, K. J. Kadow, and D. Powell, somewhat abridged in respect of apple blotch and cherry spot data, but giving further details of the apple scab results, appears in *Trans. Ill. hort. Soc., 1937*, lxxi, pp. 255–269, 1938.]

Crawford (R. F.). **Apple measles.**—*Bull N. Mex. agric. Exp. Sta.* 251, 15 pp., 3 figs., 1937. [Abs. in *Exp. Sta. Rec.*, lxxviii, 4, p. 505, 1938.]

Apple measles [*R.A.M.*, xvii, p. 400], discovered in New Mexico in 1918 and then reported as being prevalent and destructive, is most important in this locality on the Jonathan variety. The affected trees may be dwarfed and, if young, killed, and the fruit is small and poor.

Fungi isolated from affected tissues are regarded as being only associated with the disease, and not its cause. Inoculation of juice from affected into healthy tissue, as well as various types of grafting, gave no indication of the action of fungi or bacteria, and no organism was observed in histological preparations. The condition is most prevalent on soils with a high soluble salt content and in neglected orchards. Soils round affected trees were ascertained to have a soluble salt content up to 6,000 p.p.m.; measles was induced on Jonathan trees by growing them in soil with a soluble salt content of 4,000 to 6,000 p.p.m. Trees planted in soil containing 1,000 to 4,000 parts of salt per million developed marked symptoms of the condition in one season, while the controls in a soil of low soluble salt content remained normal. The alkalinity of most local soils may be a contributory factor. It is concluded that measles would appear to be a physiological condition influenced by a high soluble salt content in the soil.

Lutz (J. M.) & Culpepper (C. W.). **Certain chemical and physical changes produced in Kieffer Pears during ripening and storage.**—*Tech. Bull. U.S. Dep. Agric.* 590, 37 pp., 2 figs., 10 graphs, 1937.

In the section of this bulletin dealing with the development of decay in Kieffer pears from various parts of the United States during the processes of ripening and storage, temperatures of 70° to 80° F. are stated to have been particularly conducive to rotting, chiefly due to *Rhizopus* [*R.A.M.*, xvi, p. 518], in 1932 and 1933. A temperature of 60° produced more decay than one of 50°, but ripening was more rapid at the former. The amounts of severe rot after 20 days in the ripening room at 50°, 60°, 70°, 80°, 90°, and 100° were 0, 5·8, 39·3, 17·2, 0, and 1·3 per cent., respectively, the corresponding figures for moderate infection being 2·4, 12·8, 13·1, 8, 4·8, and 1·3, respectively, slight 10·7, 11·6, 1·2, 6·9, 4·8, and 6·3, respectively, and sound fruit 76·2, 52·3, 4·8, 2·5, 32·8, and 79·7 per cent., respectively.

Leib (E.). **Eine wenig beachtete Zwetschenkrankheit.** [A little heeded Plum disease.]—*Kranke Pflanze*, xv, 4, pp. 66–67, 1938.

In 1937 plum pockets (*Taphrina pruni*) [*R.A.M.*, xvi, p. 330], a disease of rare occurrence under German conditions, broke out in epidemic form in the western Saar, and caused an 80 per cent. crop reduction in various parts of the Saarbrücken district. In addition to thorough orchard sanitation it may be necessary to replace the affected trees by such resistant varieties as Bühlertal, Zimmer's, Ersing, and Ebersvier.

Cochran (L. C.) & Smith (C. O.). **Asteroid spot, a new virosis of the Peach.**—*Phytopathology*, xxviii, 4, pp. 278–281, 2 figs., 1938.

The name 'asteroid spot' is applied to an apparently new transmissible virus disease of peaches, first observed in 1934 at the California Citrus Experiment Station and characterized by small, star-shaped, chlorotic splotches scattered singly over the leaf surfaces and presenting the aspect of spatterings from a thick, yellow liquid. As soon as the discoloration begins to spread to the tissue surrounding the spots, abscission layers are formed and the affected leaves are shed. In green-

house experiments in which J. H. Hale nursery trees were grafted with diseased scions the typical symptoms of asteroid spot began to show after eight weeks and developed at varying rates, one tree being rapidly destroyed while in others several branches below the grafts were invaded and the older leaves shed by the end of five months. The trouble is regarded as a potentially serious peach disease, which should be handled only under controlled conditions.

MECKSTROTH (G. A.). **Relation of temperature to fall damage of Strawberries by leaf scorch.**—*Plant Dis. Reptr*, xxii, 3, pp. 56–57, 1938. [Mimeographed.]

In the late autumn of 1936, G. M. Darrow and E. B. Morrow found that Klondike strawberries in North Carolina were suffering excessively heavy damage from leaf scorch (*Diplocarpon earliana*) [*R.A.M.*, xvi, p. 394], the percentages of leaf area destroyed by the fungus in the best and worst parts of one particular field being 93 and 96 per cent., respectively (*Plant Dis. Reptr*, xxi, p. 71, 1937). Counts made in the same field on 21st April, 1937, showed that the average numbers of leaves, berries, and buds and blossoms (including blossoms killed by frost) per plant were 5·7, 3·2, and 7·8, respectively, for the scorched and 9·8, 8·4, and 15·6, respectively, for the healthy. The principal contributory factor in the autumn leaf scorch epidemic of 1936 is thought to have been the abnormally high temperatures prevailing from July to November, especially during October, when the mean reached 65·5° F., the optimum for the development of *D. earliana* being 72° to 80°.

British West Indies Fruit and Vegetable Council. Report of the First Joint Meeting of the Eastern and Western Group Councils and of the Third Meeting of the Eastern Group Council held at the Imperial College of Tropical Agriculture, Trinidad, February, 1938.—61 pp., Govt Print. Off., Port-of-Spain, Trinidad, 1938.

The following items of phytopathological interest occur on pp. 12–13 of the report. F. E. V. Smith, representing the Department of Agriculture, Jamaica, stated that banana leaf spot (*Cercospora musae*) [*R.A.M.*, xvii, pp. 404, 473] was most destructive under certain soil and climatic conditions conducive to seasonally vigorous or spasmodic growth. In typical first-class banana soils in the main cultivation centres of the Island, where steady growth was maintained and firm leaves produced, the disease, though present for at least 18 months, had caused no appreciable damage. The regular application of Bordeaux mixture by efficient methods on large estates constituted a serious problem, and it was doubtful whether any but the best-producing areas could bear the additional cost of $15.00 or more per acre per annum.

C. W. Wardlaw, of the Low Temperature Research Station, Imperial College of Tropical Agriculture, Trinidad, also emphasized the ecological background of *C. musae*, which in some districts rapidly assumed epidemic dimensions, whereas in others normal production continued, at any rate for a time, notwithstanding the presence of the fungus. Thus, during the first two years of inspection, the incidence of the disease in certain superior Trinidad soil types showed no marked tendency to

increase, thereby creating a deceptive impression of comparative unimportance which was corrected in the following season by the epidemic development of infection. This period of slow spread, during which no active control measures can be taken, represented one of the most difficult aspects of leaf spot. The collection of banana types at the Imperial College of Agriculture included a number of resistant strains, and it was reasonable to assume that the susceptible Gros Michel could be replaced.

E. E. Cheesman, Professor of Botany at the Imperial College of Agriculture, discussing the problems of plant breeding in relation to disease resistance, reported the introduction of certain wild banana types resistant to both Panama disease [*Fusarium oxysporum* var. *cubense*] and leaf spot. A variety, I.C.2, had also been produced for breeding purposes [ibid., xvii, p. 331] with adequate commercial qualities though not equal to Gros Michel in the latter respect. A search must now be made within the genus *Musa* for a male parent uniting the character of disease resistance with other desirable features.

GRANCINI (P.). **Il cancro del Fico da 'Phomopsis'.** [Fig canker due to *Phomopsis*.]—*Riv. Pat. veg.*, xxviii, 3–4, pp. 103–114, 6 figs., 1938.

Since 1924, fig trees at Santo Colombano, Italy, have been killed off in large numbers as a result of canker due to *Phomopsis cinerescens* [*R.A.M.*, v, p. 470]. The disease appears to have been aggravated by the severe winters of 1929 and 1931. Trees growing under good cultural conditions showed much stronger resistance than those grown too thickly together and inadequately manured. Frost was a predisposing factor, most of the cankers appearing on the site of cracks caused by the inclement weather. Control consists in increasing the vigour of the trees by improved cultural practices. Wilted branches (whether showing the presence of the fungus or not) should be removed, and the wounds disinfected. Spraying at the end of winter with Bordeaux mixture (3 to 4 per cent.) should be tried, and nursery cuttings should be taken from those trees that show resistance.

HOPKINS (J. C. F.). **A black rot of Papaw fruit caused by Phoma caricina sp. nov.**—*Trans. Rhod. sci. Ass.*, xxxv, 2, pp. 128–131, 1 pl., 1 fig., 1938.

Papaw fruits in Southern Rhodesia are commonly affected both on the trees and in storage by a rot which begins as a small, circular, water-soaked spot on the half-grown green fruit. The rot spreads, the affected tissues becoming much depressed, jet-black, and tough, and bearing partially erumpent pycnidia, from which long, hyaline tendrils of spores are extruded.

From diseased material a fungus was isolated with black carbonaceous, spherical, ostiolate, submerged pycnidia later becoming erumpent, but never superficial, 90 to 220 by 70 to 190 (average 112 by 129) μ, and hyaline, ovoid, ellipsoid, and allantoid conidia measuring 8 to 12 by 3 to 4 μ, extruded in long, pinkish, coiled tendrils. The fungus is named *Phoma caricina* n. sp. [with a Latin diagnosis]. Inoculations of green papaw with an aqueous suspension of the conidia, both with

and without surface injury, gave rise in each case to a typical rot, from which the fungus was reisolated.

Calvino (Eva M.). **Funghi parassiti e saprofiti della Persea drymifolia.** [Fungi parasitic and saprophytic on *Persea drymifolia.*]—*Costa azzur. agric.-flor.*, xviii, 3–4, pp. 54–59, 2 figs., 1938.

Notes are given on a number of fungal diseases affecting avocado (*Persea* [*americana* var.] *drymifolia*) at San Remo. The most serious is a wilt, which attacks the leaf apices, where it produces a reddish-brown, triangular area which, on leaves exposed to the north, spreads along the margin and thence into the veins, and finally reaches the petiole. A grey area appears within the reddish discoloration at the leaf tip, together with rusty areas bounded by concentric circles. Acervuli are found on the lower surface. When practically all the leaves have become affected defoliation sets in, and the young branches and inflorescences may be attacked, and rapidly wither, infection then spreading to the older branches. Isolations from infected leaves yielded a *Gloeosporium* [cf. *R.A.M.*, iv, p. 653; v, p. 110; xv, p. 363] apparently distinct from *G. musarum*, and which the author names *G. perseae-drymifoliae* n. sp. ad interim [with a Latin diagnosis]. It is characterized by subepidermal, later erumpent, fuscous-black acervuli, 300 to 500 μ in diameter, hyaline, septate, erect conidiophores 6 to 8 μ long, acrogenous, hyaline, ellipsoidal or obovate, often curved conidia with a round apex, and measuring 22 to 32 (usually 24 to 26) by 8 to 10 μ. A variant on the fruits of avocado, with conidia measuring up to 8 to 12 by 3 to 4 μ, is named *G. perseae-drymifoliae* var. *fructigena*.

The susceptibility of the fruits to infection varies greatly with the variety, those with a tough epicarp remaining unaffected, even when the leaves are attacked. The cracks developing in diseased fruits become invaded by *Cladosporium herbarum*. Control consists in removing the fallen leaves and spraying the plants with 1 per cent. copper-lime before the flower buds open and until after they have expanded.

In the leaf and inflorescence traces of the same host the author found an apparently new species of *Pestalozzia* [cf. ibid., xv, p. 487] with conidia measuring 32 to 40 by 6 to 7 μ, which she names *P. perseae-drymifoliae* n. sp. [with a Latin diagnosis].

Other records on avocado are *Colletotrichum gloeosporioides* [ibid., xiv, p. 707], *Hendersonia sarmentorum*, *Ascochyta* sp., and *Phyllosticta perseae*. The paper concludes with a list of other diseases of avocado found in tropical regions.

Bertin (C.). **Les mouillants agricoles.** [Agricultural wetters.]—*Progr. agric. vitic.*, cix, 17, pp. 396–399, 1 graph, 1938.

After briefly discussing the value of wetting agents in spray mixtures used on vines and emphasizing the importance of determining the proper quantity to be added, the author points out that certain French dealers greatly underestimate the proper dosage, the figure in some instances being determined by adding the wetter to water only or by tests made on dead plant cells. His own tests are made with a mixture containing 2 kg. copper sulphate and 1 kg. lime per hectol. water. When the mixture and wetter together have been filtered, a total of 130 drops per

5 c.c., as determined by Duclaux's drop-counter, demonstrates, in his opinion, that the wetting agent is perfectly reliable for ordinary purposes when used on any variety of vine and at any hour of the day.

WILLAUME (F.). **Deuxième contribution à l'étude de l'action photosensibilisatrice de quelques traitements antiparasitaires.** [A second contribution to the study of the photo-sensitizing action of some anti-parasitic treatments.]—*Rev. Path. vég.*, xxv, 2, pp. 94–110, 1 pl., 1 diag., 1938.

In this further, supplementary account of experiments in which copper-containing fungicides and insecticides were exposed to the rays of a Challonge and Lambrey hydrogen tube [*R.A.M.*, xv, p. 452; xvi, p. 625], the author states that the data obtained show that the absorption of the ultra-violet rays of sunlight by certain fungicides favours the assimilation of nitric nitrogen by the higher plants (4,000 to 3,400 Å), stimulates their growth (3,400 to 2,900 Å), increases their resistance to fungal infection (3,000 Å and under), increases the fungicidal effect of the preparations tested (3,000 Å and under), and aggravates their scorching properties (beyond 2,900 Å). Twenty-three bibliographical references are given.

VIDAL (V. A. C.). **Contribuição para o estudo quimíco-analítico dos insecticidas e fungicidas.** [A contribution to the chemico-analytical study of insecticides and fungicides.]—*Rev. agron., Lisboa*, xxv, 3, pp. 235–243, 1 fig., 1937. [Received July, 1938.]

Details are given of the methods officially employed in Portugal for the determination of the water content and content of active chemical principles of a number of standard insecticides and fungicides. From a table showing the analytical data obtained it appears that Schloesing's mixture (used against wheat bunt, *Tilletia caries* and *T. foetens* [*R.A.M.*, xvi, p. 594]) contains 15·88 per cent. copper per 100 gm. of the product sampled. The copper oxychloride content of Caffaro powder [ibid., i, p. 66 *et passim*] is 27·02 per cent.

GRAM (E.). **Statens plantepatologiske Forsøg. 1913–1938.** [The State Phytopathological Service. 1913–1938.]—*Tidsskr. Planteavl*, xliii, 1, pp. 159–176, 2 figs., 2 graphs, 1938.

An account is given of the organization and functions of the Danish Phytopathological Service, with an outline of its history from its inception in 1913, as a branch of the Plant Cultivation Experiment Service, to the present day. Among the many activities of the Service may be mentioned its advisory, propaganda, and reporting work in connexion with plant diseases, its quarantine arrangements, and its analytical investigations of disinfectants, including plant protectives [*R.A.M.*, xvii, p. 332].

EWELL (A. W.). **Present use and future prospects of ozone in food storage.**—*Food Res.*, iii, 1–2, pp. 101–108, 1938.

The writer summarizes and discusses the use of ozone [*R.A.M.*, xvi, p. 18 and next abstracts] in the preservation of stored foodstuffs from fungal and bacterial contamination.

Both bacteria and moulds absorb moisture during growth. The faster growing of the two consumes so much of the available water that the development of the other is checked. A fall in temperature reduces bacterial growth much more than that of moulds. Below about 3° C. moulds grow much more rapidly than bacteria unless the latter have obtained an advantage by high initial infection, whereas above that temperature superficial spoilage is normally of bacterial origin. A heavy growth of mould appears in the course of a few weeks on beef free from severe initial bacterial infection at a temperature range of 1° to 3° and a humidity of 90 per cent. or more. Ozone is much more effective in checking moulds than bacteria, and with 'clean' meat at the above-mentioned temperatures it invariably defers the development of fungal contamination from about a fortnight to two months. The best procedure is a two-hour ozonization twice a day at a concentration of $2\frac{1}{2}$ to 3 p.p.m.

Small fresh fruits, e.g., strawberries, raspberries, currants, and grapes (particularly of the sweet wine type), are specially liable to mould, and their storage period may be doubled by 2 or 3 p.p.m. of ozone applied continuously or for several hours daily, while a similar treatment is also beneficial in the case of apples, eliminating the disagreeable 'dead' odour frequently noticeable in stored fruit. The gas is further valuable in the preservation of butter, cream, fresh fish, and many vegetables, but its outstanding success has been achieved in egg rooms, where moulds [ibid., xvii, p. 322] increase rapidly in the very humid atmosphere necessarily maintained to counteract shrinkage from evaporation. A minimum of 0·6 p.p.m. ozone is required to prevent infection in reasonably 'clean' eggs, whereas for 'dirty' ones or those already contaminated a concentration of 1·5 p.p.m. is advisable. For the purpose of egg preservation a continuous supply of ozone is preferable to the intermittent introduction of the gas. Under these conditions eggs kept at —0·6° with a relative humidity of about 90 per cent. are indistinguishable after eight months' storage from those a few days old.

The paper concludes with a brief consideration of the shortcomings of the ozonization methods in current use and suggestions for their improvement.

Rogerson (J. T.), Campbell (W. D.), Reid (W. D.), & Neill (J. C.). **Practical sterilization of meat-wraps.**—*N. Z. J. Sci. Tech.*, xix, 11, pp. 697–700, 1 diag., 1938.

The ordinary method of sterilizing meat wraps (cotton stockinette and hessian jute) with heat-vaporized formalin gas having been shown to be entirely ineffective against bacteria and moulds [cf. preceding abstract] in New Zealand, other possibilities of sterilization by heat were explored. Empey's dry heat method (*J. Coun. sci. industr. Res. Aust.*, x, p. 57, 1937) proved impracticable for works use, since the temperatures required to destroy all the bacteria on the wraps were so high that risk of damage to the fabrics was incurred. It was ascertained by further experimentation, however, that complete disinfection could be secured by 30 minutes' exposure of the wraps to an air temperature of 205° F. in a saturated atmosphere. Details are given of the construction and operation of a chamber at the Longburn Freezing Works, in

which the method was tested with highly successful results, the cost of erection being £263 and the running costs 19*s*. 3½*d*. for the treatment of 2,000 to 3,000 bags.

Prescott (S. C.) & Tanner (F. W.). **Microbiology in relation to food preservation.**—*Food Res.*, iii, 1–2, pp. 189–197, 1938.

This is a summary, supplemented by critical observations and suggestions, of some recent literature on the role of micro-organisms (including fungi) in the spoilage of stored foods, with special reference to those preserved by exposure to low temperatures or freezing [see above, p. 577].

Berger (G.). **Contribution à la connaissance des parasites des plantes cultivées en Chaouia (Maroc).** [A contribution to the knowledge of the parasites of plants cultivated in Chaouia (Morocco).]—*Rev. Path. vég.*, xxv, 2, pp. 135–143, 1 pl., 1938.

Short, popular notes are given on 29 fungi found on market-garden crops (including flowers) in Morocco [cf. *R.A.M.*, xvii, p. 506].

Hofmann (W. F.). **A review of work done on mildew prevention.**—*Amer. Paint J.*, xxii, pp. 22, 24, 58, 60, 1938. [Abs. in *Chem. Abstr.*, xxxii, 7, p. 2766, 1938.]

The effective concentrations against paint mildew [*R.A.M.*, xvii, p. 195] of mercuric chloride, cuprous oxide, mercuric oxide, sodium silico-fluoride, phthalic anhydride, and certain trade products are given. By the use of a high pigment concentration of hard-drying pigments, such as zinc oxide, trouble from this source has been reduced, while good results have also been obtained by the incorporation in the vehicle of a good spar varnish, producing a faster drying film with less time for spore attachment and a hard surface tending to repel the adhesion of these organs. Mildewed surfaces to be repainted should be scrubbed with trisodium phosphate or sodium carbonate solutions (1 lb. per gal. water), with the addition if necessary of a 1 : 600 solution of mercuric chloride. One or two coats of superior paint with a good spar varnish and a suitable fungicide are necessary.

Henderson Smith (J.). **Some recent developments in virus research.**—*Ann. appl. Biol.*, xxv, 2, pp. 227–243, 1938.

In this presidential address to the Association of Applied Biologists the author discusses the problems of control of virus diseases and emphasizes two main means of achieving it: the sowing of clean material and keeping the crop clean through the period of growth. The use of clean seed usually ensures a virus-free crop, although this is disputed in the case of tomatoes and cucumbers, probably because the evidence for and against seed-borne infection has been based on work with different viruses. In the case of vegetatively propagated crops elaborate testing of the parent material is necessary; inspection of the potato crop, as practised in England, and the American system of tuber-indexing are fairly successful. The transmission of infection by insects constitutes the main problem in the control of virus diseases, but no practicable method of controlling the vectors has yet been devised. So far the only successful general method of control has been the breeding and selection

of resistant varieties, but recently a new method of immunization which is still in the experimental stage has been developed independently by several workers, of whom Salaman is stated to have been the first to realize its practical significance. A discussion follows on the nature of viruses, based mainly on the work of Stanley and Bawden and Pirie, and the author concludes with the observation that, although some of the viruses may be living organisms, it appears to be established that others are not.

SEIFFERT (G.). **Virus and Viruskrankheiten bei Menschen, Tieren und Pflanzen. Biologische Einführung in die allgemeinen Forschungsergebnisse, praktischen Anwendungen und Arbeitsmethoden.** [Virus and virus diseases of man, animals, and plants. A biological introduction to the general results of research, practical applications, and experimental methods.]—xii+221 pp., 7 figs., Dresden, T. Steinkopff, 1938. Rm. 16. [Abs. in *Zbl. Bakt.*, Abt. 1 (*Ref.*), cxxix, 23–24, p. 527, 1938.]

The general section of this treatise, stated by the reviewer to embody the latest results of virus research, deals briefly with the most important properties of the viruses and explains the fundamental principles underlying pathogenesis, immunity, protective inoculation, and epidemiology. The special section is devoted to individual virus diseases of man, animals, insects, and plants, and to the relationship between virus infection and tumours, while virus-like organisms and filterable bacterial forms are also discussed. The technique of virus studies is described in a short concluding chapter. A valuable feature of the manual is the full treatment of the relevant foreign literature, some of which is not readily accessible, while the question of the interpretation of viruses and the many unsolved problems of the diseases caused by this group of entities are handled in a stimulating manner.

LYNEN (F.). **Das Virusproblem.** [The virus problem.]—*Angew. Chem.*, li, 13, pp. 181–185, 1 graph, 1938.

This is a survey of recent studies on the nature of viruses, including that of tobacco mosaic, reference to which has already been made in this *Review*.

KAUSCHE (G. A.). **Über eine Trennungsmöglichkeit von Mischviren auf Grund ihrer differenten P_H Stabilität.** [On the possibility of separating mixed viruses on the basis of their differential P_H stability.]—*Naturwissenschaften*, xxvi, 14, p. 219, 1938.

Experiments were conducted at the Biological Institute, Berlin-Dahlem, to determine the practicability of separating the tobacco mosaic viruses from the X and Y potato mosaic viruses in mixed preparations, by varying the hydrogen-ion concentration of the sap [cf. *R.A.M.*, xvii, p. 544]. The potato mosaic viruses were found to be inactive at below P_H 3·2, and after seven days at P_H 1·5 only the tobacco mosaic virus remained active. At P_H 4·5 to 7·5 none of the viruses was affected. At P_H 9·9 the tobacco mosaic virus was inactivated in four days while the X virus of potato retained its full activity during the same period.

It is therefore possible to separate naturally and artificially mixed viruses by the method indicated, and it would seem that the potato mosaic viruses, which are sensitive to oxidation, might be protected from the catalytic action of heavy metals in the acid hydrogen-ion range by the introduction of complex-forming buffer substances.

VAN LUIJK (A.). **Antagonism of Penicillium spec. versus Pythium Debaryanum.**—*Chron. bot.*, iv, 3, pp. 210–211, 1938.

Investigations by the author showed that *Penicillium* spp., isolated from vegetable mould and grown in nutrient solutions, formed metabolic products which had a more markedly inhibiting effect on the growth of *Pythium de Baryanum* than those of any other organism tested. Proof was obtained that these substances are thermostable and are absorbed by kaolin and norit. The main factor determining their formation was the nature and concentration of the source of carbon, maltose causing the highest toxicity, though other mono- and disaccharides (except lactose) were also suitable. With organic nitrogen compounds the toxicity was very weak, while with polysaccharides it was intermediate. Cultures of *Penicillium* with 0·5 per cent. saccharose were toxic up to a dilution of 1 in 128, and with 4 per cent. saccharose up to 1 in 1,280, this latter figure being equivalent in toxicity to *P. de Baryanum* to 0·2 per cent. mercuric chloride. The toxic effect of *Penicillium* towards *Gibberella fujikuroi* was 200 times weaker than towards *P. de Baryanum.*

A damping-off of lucerne seedlings in unsterilized soil in a hothouse was completely arrested by a culture of *Penicillium.* After the inoculation of sterile soil in pots with *P. de Baryanum* up to 90 per cent. of lucerne seedlings in these pots were killed. When 12·5 c.c. of sterilized culture liquid of *Penicillium* were added to 200 c.c. of soil the development of *Pythium* was completely inhibited. This effect was not produced when the *Penicillium* culture or culture liquid was replaced by spores, probably owing to the absence of the suitable carbohydrates.

In pure culture *in vitro* the *Pythium* infection gave 100 per cent. positive results, but when 0·08 c.c. of sterilized *Penicillium* liquid was added the seedlings were as healthy as the controls.

It is considered that these growth-inhibiting substances may provide a basis for the disinfection of soil in pot cultures.

BAUER (R.). **Beiträge zur Physiologie von Dematium pullulans de Bary.** [Contributions to the physiology of *Dematium pullulans* de Bary.]—*Zbl. Bakt.*, Abt. 2, xcviii, 5–9, 133–167, 4 figs., 1 diag., 2 graphs, 1938.

This is a very detailed account, supplemented by 55 bibliographical references, of the author's study on the physiology of *Dematium* [*Pullularia*] *pullulans* de Bary isolated in 1931 from a sooty mould on an elm leaf.

The effects of different nutrient media, conditions of aeration, hydrogen-ion concentration, and neutral salt content of the medium on the growth of the fungus in culture are described, with particular reference to the relative amounts of mycelium and conidia produced, the forma-

tion of abnormal cells, of slime, and of melanin. The osmotic relations and the carbon and nitrogen metabolism of the fungus were also investigated, and are discussed at length.

SCHOPFER (W. H.) & BLUMER (S.). **Les facteurs de croissance des espèces du genre Ustilago.** [Growth factors in species of the genus *Ustilago*.]—*C.R. Acad. Sci., Paris*, ccvi, 14, pp. 1141–1143, 1938.

Of ten species of *Ustilago* supplied by the Bureau voor Schimmelcultures, Baarn, and grown on the synthetic medium used with such excellent results in the case of *U. violacea* [*R.A.M.*, xvii, p. 247], seven were found to be auxo-autotrophic, i.e., capable of attaining perfect development without the addition of an accessory growth substance, viz., *U. zeae*, *U. tritici*, *U. levis* [*U. kolleri*], *U. nuda*, *U. hordei*, *U. avenae*, and *U. bromivora* [ibid., xvii, p. 45] (both sexes). One species, though strictly speaking auxo-autotrophic, responded by a slight increase of growth to the addition to the nutrient medium of aneurin or the pyrimidin constituent alone, namely, *U. longissima* [ibid., xii, p. 88] (both sexes). One species, *U. violacea*, has already been shown to be auxo-heterotrophic in these experiments. *U. scabiosae* behaved similarly, making no appreciable growth in the absence of aneurin, attempts at the replacement of which by its two components, pyrimidin and thiazol, were unsuccessful. As in the case of the Mucorineae and other groups investigated, extracts of the autotrophic species were capable of inducing the development of the heterotrophic species on a synthetic medium.

KURSANOFF (L. I.) & MEDVEDEVA (Mme S. B.). К вопросу об эволюции паразитизма у грибов. I. Влияние *Chrysomyxa pirolae* Rostr. на строение и функции хозяина *Pirola rotundifolia* L. [On the evolution of parasitism in fungi. I. The influence of *Chrysomyxa pirolae* Rostr. on the structure and the functions of the host *Pirola rotundifolia* L.]—*Bull. Soc. Nat. Moscou, Sect. biol.*, N.S., xlvii, 2, pp. 119–130, 1938. [French summary.]

The relation between the [spruce] rust *Chrysomyxa pyrolae* [cf. *R.A.M.*, xv, p. 618] and its alternate host *Pyrola rotundifolia* is described as a case of highly developed physiological balance typical of obligate parasitism in the Uredinales. The diploid mycelium of *C. pyrolae* persists from year to year in the roots of *P. rotundifolia* and invades the buds each year. The leaves developing in the following year are permeated by the mycelium yet do not appear diseased, and the regular functions of the plant are not noticeably disturbed till the third year, when the fungus produces both uredospores and teleutospores and eventually kills the leaves towards the end of the summer. During the second year only very slight anatomical changes occur in the leaves, and a very slight or negligible increase in the intensity of respiration, photosynthesis, and starch formation, but the chlorophyll content was found to be 12·5 per cent. lower and the transpiration 68 per cent. higher than in healthy leaves [cf. ibid., xvii, p. 478]. During the third year (about one month previous to the death of the leaves) respiration was 30 per cent. higher, intensity of photosynthesis 26·6 per cent. lower, and transpiration $2\frac{1}{2}$ times higher than in healthy leaves.

GULYÁS (A.). **A Burgonya virusbetegségei. A virusok jelentösége a leromlásban és az ellenük való védekezések.** [The virus diseases of Potato. Their importance in connexion with degeneration and their control.]—Reprinted from *M. Kir. Gazdas. Akad. Mun.*, i, 3, 63 pp., 33 figs., 1 map, 1938. [German and English summaries.]

Up to the present no adequate work dealing with virus diseases of Hungarian potatoes has been published, and the author points out that a more comprehensive knowledge of the subject would pave the way to efficient control. Among the different types of virus diseases occurring in Hungary the mosaic type is stated to cause the heaviest losses. Leaf roll is widespread and chiefly attacks the Autumn Rose variety. Rugose mosaic, which is stated to be caused by a composite virus [cf. *R.A.M.*, xvii, p. 339], frequently occurs on the Gül Baba variety. The A, X, and Y viruses are also common, while apical leaf roll, chlorotic spotting, calico, and aucuba mosaic occur more rarely. The paracrinkle virus attacking the French Roll variety changes the shape of the tubers. A mosaic disease causing necrotic spots between the veins of the leaves is very often observed on the Rose potato of Lovászpatona. In trials the varieties Görög, Mgc. 36, Kossuth, Mindenes, Nem, Ella, Krüger [President], Mgc. 14, Margit, Öröm, Gondüzö, Wohltmann Gyöngye, and Áldás were fairly resistant to virus diseases. It is recommended that control measures should be applied in breeding and propagating establishments and should be carried out by the State.

BAWDEN (F. C.) & PIRIE (N. W.). **Liquid crystalline preparations of Potato virus 'X'.**—*Brit. J. exp. Path.*, xix, pp. 66–82, 1938.

The authors describe their method of isolation of nucleo-proteins from white Burley tobacco, *Nicotiana glutinosa*, and Kondine Red tomato infected with the S and G strains of potato virus X [*R.A.M.*, xv, p. 390]. Leaves picked from small inoculated plants about a month after infection with strain S, i.e., about three weeks after the symptoms appear, were minced, the sap expressed through muslin, heated with continuous stirring to 60° C., rapidly cooled, and the resulting green, flocculent coagulum thrown down by a few minutes centrifuging at 3,000 r.p.m. The brown, opalescent supernatant fluid was then one-quarter saturated with ammonium sulphate (185 gm. per l.) or brought to P_H 4·5 by the addition of sulphuric acid, producing a brown precipitate containing all the virus. After centrifuging, the precipitate from 1 l. of sap was suspended in 100 c.c. of water, neutralized with dilute caustic soda, centrifuged to remove insoluble materials, and further purified by precipitation and resuspension [by a procedure which is precisely described].

The purified viruses appeared to be solid masses of nucleoprotein, the X-ray measurements of the particles showing a perfect internal regularity of the type found in some large protein molecules. These results indicate that other viruses may also be proteins, as has been suggested in recent studies on *coli* phage by Schlesinger (*Nature*, Lond., cxxxviii, p. 508, 1936) and *Staphylococcus* phage by Northrup (*Science*, N.S., lxxxvi, p. 479, 1937). The 2 per cent. solutions of both strains of the virus were colourless and only faintly opalescent; they remained

liquid crystalline at room temperature until diluted to about 1·5 per cent. Concentrated solutions were spontaneously bi-refringent and dilute solutions showed anisotropy of flow; the nucleoproteins formed bi-refringent jellies when sedimented by high-speed centrifugation and appeared amorphous under the microscope when precipitated with acid or ammonium sulphate. Systemic infection was obtained with 10^{-9} gm. and specific serological reactions with $\frac{1}{6 \times 10^6}$ gm. It was found that purification caused potato virus X to aggregate into rods and reduced its filterability progressively. The virus was inactivated by heat, drying, irradiation, and chemical treatments; only when the protein was denatured was the loss of infectivity followed by loss of serological activity and of optical properties. No significant differences were found in the yields or the physical and chemical properties of the two strains, S and G, and the difference in symptoms caused by them is believed to be the effect of their specific side groups, which they are likely to possess just as they are known to possess specific antigens. A comparison of potato X virus and tobacco mosaic virus showed that they break down differently when heated and that only the former is susceptible to tryptic digestion.

Sanford (G. B.). **Studies on Rhizoctonia solani Kühn. IV. Effect of soil temperature and moisture on virulence.**—*Canad. J. Res.*, Sect. C, xvi, 5, pp. 203–213, 1 pl., 2 graphs, 1938.

In continuation of his studies on the parasitism of *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xvii, p. 481] on potato sprouts, the author found in pot experiments with artificially infected soil that the optimum temperature for and the rate of growth of *C. solani* varied with different isolates of the fungus. The pathogen seemed equally virulent and the type of injury not essentially different throughout the range of soil water contents from 19 to 40 per cent. at temperatures between 16° and 23° C., but the severity of the disease decreased abruptly at 25°. The rate of growth of the fungus at 16° or 23° was slightly higher in a wet soil than in one of medium water content, but it was somewhat less at 23° in a dry soil than at 16° in a medium or wet soil. In a soil of 20 per cent. water content at 16° the pathogen grew 5 cm. in ten days; in a fertile, steam-sterilized loam of medium water content it grew in ten days as far as it did in four on a nutrient medium. The growth of secondary and tertiary sprouts from severely injured primary sprouts, as a means of recovery, was better in wet than in dry soil at both 16° and 23°, but best in a wet soil at 23°. A high percentage of these secondary sprouts appeared to be highly resistant under conditions in which the primary sprouts were very susceptible and severely attacked by the fungus.

Frederiksen (T.), Jørgensen (C. A.), & Nielsen (O.). **Undersøgelser over Kartoflens Rodfiltsvamp og dens Bekæmpelse.** [Investigations on the Potato stem canker fungus and its control.]—*Tidsskr. Planteavl*, xliii, 1, pp. 1–64, 5 figs., 1938. [English summary.]

This is an exhaustive, fully tabulated account of the symptomatology, life-history, reaction to environmental and cultural conditions,

and control of stem canker of potatoes (*Corticium solani*) [see preceding abstract] under Danish conditions [*R.A.M.*, xiii, p. 720].

The well-known distinguishing features of the disease are recapitulated. The sclerotia on the tubers constitute one of the main sources of infection of the new crop. The normal functions of the roots and young stolons are no doubt impeded by the numerous necrotic lesions developing on these organs, but of much greater importance are the unilateral or girdling cankers on the young stems, the tips of which die before reaching the surface of the soil, while many of the successively produced lateral shoots are also in turn attacked. The growth of severely infected plants, if they survive, is greatly retarded. The foliage of affected plants is chlorotic and the young leaves are often bunched together in rosettes.

A study of monospore cultures of the fungus on potato dextrose agar confirmed the conclusions reached by previous workers as to its life-cycle. The name *C. solani* is preferred to *C. vagum* [ibid., iii, p. 439; ix, p. 739]; the arguments for the identity of the latter with the stem-canker organism are not regarded as convincing.

C. solani has been found to be practically ubiquitous in Denmark, not only on the root system of potato plants but also in the soil, among the heavily infected varieties being King Edward, Preussen, Edeltraut, and Birgitta, while Ackersegen, Gustav Adolf, and Tylstrup Odin are relatively resistant. The type of soil—sand, loam, or humus—and its hydrogen-ion concentration (from P_H 4·7 to 7·6) were found to be of little importance in the development of stem canker, but the disease assumed a more severe form on early (6th to 16th April) than on late (6th to 19th May) planted seed, and to a lesser extent on pre-germinated material. Deep planting (12 cm.) is also conducive to heavy infection, which is minimized by shallow planting. Soil infection may be kept within bounds by a six-year crop rotation, while clean tubers may be obtained by early lifting (about 1st October for Deodara) [cf. ibid., xi, p. 259]. In an extensive series of seed disinfection trials, very good results were secured by five minutes' immersion in a solution of 2 in 1,000 mercuric chloride plus 1 per cent. hydrochloric acid, and by a 30 minutes' dip in 0·5 per cent. uspulun, which may also be used in the dry state mixed with talc in the ratio of 5 : 95. However, notwithstanding the reduction of infection, there was no appreciable gain in the crop yields from the treated seed.

Small (T.). **The relation between Potato blight and Tomato blight.**— *Ann. appl. Biol.*, xxv, 2, pp. 271–276, 1 pl., 1938.

Potato and tomato crops grown in close proximity in the open in Jersey suffer from severe attacks of blight (*Phytophthora infestans*) [*R.A.M.*, xv, p. 689], believed by most growers to pass from potatoes, which are attacked first, to tomatoes. In four out of five pot experiments tomatoes inoculated with blight from glasshouse potatoes became infected, but blight from the early outdoor potato crop often failed to infect tomatoes. Early potatoes interplanted with tomatoes in the field were quickly killed by the disease, while the tomatoes remained almost healthy. On the other hand, potatoes infected with conidia taken from the leaves, stems, or fruits of tomatoes, became diseased.

While, therefore, diseased early potato crops are not very dangerous to neighbouring tomato crops, the latter may be a serious menace to the former. Blight lesions did not develop on tomatoes inoculated from outdoor potatoes in the autumn. The results of numerous inoculation experiments supported the view that more than one strain of the fungus exists [cf. ibid., xvi, p. 349; xvii, p. 483, *et passim*] in Jersey.

AKAI (S.). **On the ash figures of leaves of the Rice plant grown under a combination-practice of several effective measures for the control of blast disease.**—*Ann. phytopath. Soc. Japan*, vii, 3–4, pp. 173–192, 3 figs., 1938. [Japanese, with English summary.]

As a result of a comparative analytical study [full data on which are given] of the leaves of rice grown under a combination of practices designed to control *Piricularia oryzae* [*R.A.M.*, xvii, p. 133] and of those of plants cultivated by ordinary methods, the author concludes that the number of silicated epidermal cells per unit area of leaf, especially of the bulliform cells (which are penetrated by the fungus more easily than the long and short cells), was larger in plants grown under such combination practices than in those grown by ordinary methods.

SHIMADA (S.). **Infektionsweise der Blätter der Reispflanzen durch Piricularia oryzae.** [The mode of infection of the leaves of Rice plants by *Piricularia oryzae.*]—*Agric. & Hort.* [*Japan*], xii, pp. 1106–1108, 1 fig., 1937. [Japanese. Abs. in *Jap. J. Bot.*, ix, 2, p. (79), 1938.]

Recent studies in Japan have shown that *Piricularia oryzae* penetrates rice leaves [see preceding abstract] through the cuticle, especially that of the guard and accessory cells. The conidia germinating on the leaf surface form appressoria which send out slender infection hyphae into the cell tissues; these appressoria may be produced, not only on rice leaves but also on those of other plants not susceptible to *P. oryzae* without necessarily causing infection, and even on glass disks. Foliar injury was found to cause an appreciable increase of infection by the blast organism.

RYKER (T. C.) & GOOCH (F. S.). **Rhizoctonia sheath spot of Rice.**—*Phytopathology*, xxviii, 4, pp. 233–246, 5 figs., 1 graph, 1938.

Sheath spot of rice, the causal organism of which is herein described as a new species of *Rhizoctonia*, *R. oryzae* [with a diagnosis in English only], is characterized under Louisiana conditions [*R.A.M.*, xvi, p. 709] by the presence on the lower sheath, and occasionally on the leaves, of straw-coloured, red-bordered lesions, averaging 1 to 3 but sometimes reaching 10 cm. in length and about half as wide, usually situated above the water line and frequently just below the ligule. The disease generally appears during the latter part of July and increases in prevalence until September, affecting all the commercial varieties with equal severity. In 1936 the percentage of infection in different fields ranged from a trace to 50 per cent. *Echinochloa crus-galli* growing in rice plantations is also liable to attack by *R. oryzae*.

Evidence is presented and discussed in support of the writers' belief that the Louisiana fungus is quite distinct from the causal organism

of a similar sheath disease of rice in Japan [ibid., xiii, p. 271], China [ibid., xiii, p. 725], the Philippines [ibid., xi, p. 1], and Ceylon [ibid., xi, p. 599]. *R. oryzae* grows well on plain maize meal, potato dextrose, or bean-pod agar, producing a hyaline to white mycelium consisting of short-celled, extensively branching hyphae which intertwine and anastomose, forming sclerotial masses of varying shades of salmon; the latter do not occur on the host in nature.

Positive results were obtained in inoculation experiments on the Fortuna, Blue Rose, Rexora, Early Prolific, and Colora varieties with *R. oryzae*, *R.* [*Corticium*] *solani*, and *R. zeae* [ibid., xiv, p. 232], all isolated from rice sheath spots, but not with *Trichoderma lignorum* from the same host. More virulent infection followed the direct application of the inoculum to the ligule region than its admixture with the soil, which in certain instances failed to cause symptoms of the disease. Pepper [*Capsicum annuum*], eggplant, tomato, and beans [*Phaseolus vulgaris*] were not attacked by *R. oryzae* or *R. zeae*, but the last-named reacted to inoculation with *Corticium solani* [ibid., xvi, p. 611] by a substantial reduction of germination and the development of lesions. Blue Rose rice seedlings were also injured by a mixture of *C. solani* cultures from 'damped-off' pepper plants.

The optimum temperatures for the growth of *R. oryzae* and *C. solani* were found to be close to 32° and 28° C., respectively, the minimum for both being below 10° and the maximum above 35°. The growth rates of *R. zeae* were essentially similar to those of *R. oryzae*.

Baldacci (E.). **Il 'brusone' del Riso da cause non parassitarie.** [Non-parasitic 'brusone' of Rice.]—*Ital. agric.*, lxxv, 1, pp. 63–68, 1938.

Renewed attention is being paid to the etiology and control of 'brusone' of rice in Italy [*R.A.M.*, xvii, p. 61 and next abstract] in consequence of the severity of the disease in recent years. Negative results were given by inoculation experiments with two strains of *Piricularia oryzae* isolated from the culm and leaves and with one of a *Helminthosporium*, probably *H. oryzae* [*Ophiobolus miyabeanus*] from the foliage, and the disorder is attributed to adverse physical, chemical, or biological soil factors, possibly correlated primarily with anaerobiosis.

Chiapelli (R.). **Mezzi di difesa contro il brusone del Riso.** [Methods of combating 'brusone' of Rice.]—*G. Risicolt.*, xxviii, 4, pp. 63–66, 1938.

The fundamental cause of the 'brusone' disease of rice in Italy [*R.A.M.*, xi, p. 400 and preceding abstract], which commonly assumes the form of a collar rot associated with the mycelium of a sterile fungus, is thought to lie in excessive soil fertility, in particular as regards a superabundance of nitrogen. In new plantations, where the disorder is most prevalent, superphosphate and potassium chloride should be applied at the rates of 8 to 10 and 3 to 4 quint. per hect., respectively. In old fields the continuous use of calcium cyanamide at the rate of 3 to 4 quint. per hect. markedly improves the chemical condition of the soil, while a further amelioration may be effected by a winter application (after ploughing) of lime (3 to 4 quint. quicklime or 8 to 10 of ground calcium carbonate per hect.). Other factors contributing to the

occurrence of 'brusone' are the presence of stagnant water in the fields and sudden falls of temperature. The cultivation of the Bertone variety has had to be practically abandoned on account of its liability to 'brusone', to which the widely grown Maratelli is also gradually succumbing; so far American 1600 and Chinese Original appear to be resistant.

MURRAY (R. K. S.). **Root disease with special reference to replanting.**—*Quart. Circ. Ceylon Rubb. Res. Scheme*, xv, 1, pp. 24–31, 1938.

In an address given to the Sabaragamuwa Planters' Association in January, 1938, the author describes the mode of life and parasitism of *Fomes lignosus*, *F. noxius*, and *Poria hypobrunnea* [*R.A.M.*, xvii, p. 202] causing root disease of *Hevea* rubber in replanted clearings. There is reason to believe that the rhizomorphs of the fungi are likely to spread along the roots only during the first few months after felling while the roots are still fairly fresh. In most of the replanted clearings known to the author the number of diseased trees amounted to considerably less than 1 per cent. of the total stand. As a measure of control the author recommends the removal of all old roots immediately after felling in clearings where the presence of root disease is definitely known, but this measure is considered uneconomic where the disease is not suspected. The use of leguminous plants as indicators is not advised, as interfering with the usual agricultural practices and not offering sufficient evidence as to the presence of the fungi in question, their death being also caused by other organisms. On the other hand it is suggested that the young rubber plants themselves can serve as indicators, and as soon as they show symptoms the source of infection should be traced and eliminated.

NIETHAMMER (ANNELIESE). **Wachstumsversuche mit mikroskopischen Bodenpilzen.** [Growth experiments with microscopic soil fungi.]—*Arch. Mikrobiol.*, ix, 1, pp. 23–30, 1938.

Full details are given of the writer's experiments at Prague, Czechoslovakia, to determine the effect of the addition of various metallic compounds to a synthetic cane sugar culture medium on the growth at 20° C. of a number of widely distributed soil fungi [*R.A.M.*, xvii, pp. 64, 484].

The production of conidia by *Trichoderma koningi* was inhibited by nickel sulphate at concentrations of 0·0001 to 0·05 per cent.; in the case of zinc and iron sulphates conidia were produced in the presence of these compounds at strengths of up to 1·0005 per cent. Sodium fluoride exerted an injurious action on the mycelium at 0·0001 to 0·005 per cent. and completely suppressed development at higher concentrations. Conidial germination was inhibited by germisan at 0·0001 to 0·005 per cent. No conidia were produced in the synthetic solution without the addition of metals.

Acaulium nigrum formed perithecia under the influence of iron and zinc sulphates at 0·0001 to 0·005 per cent., while the production of conidia was induced by 0·0001 to 0·005 per cent. nickel sulphate. In the control series chlamydospore formation was abundant but no reproductive organs developed.

The joint admixture with the culture solution of iron and zinc sulphates (0·0001 to 0·05 per cent.) stimulated the production of the characteristic purple pigmentation by *Fusarium oxysporum*.

The formation of conidia in *T. koningi* was further induced by filtrates from 10-day-old cultures of *Penicillium luteum* and *P. expansum* in cane sugar solution (0·1 per cent.), and by an extract of dried beet leaves (2 c.c. per 18 c.c. solution), whereas a similar extract of *Ranunculus bulbosus* 'bulbs' inhibited the process.

In experiments to ascertain the reciprocal influence of seedlings and fungi grown together in Erlenmeyer flasks on 1 per cent. agar at 19° to 26° the roots of wheat secreted a substance toxic to *P. expansum*, the development of which was further retarded by seed treatment with abavit dust. Both *Dematium* [*Pullularia*] *pullulans* and *T. koningi* made profuse growth on the wheat seedlings, the former producing an abundance of small, circular, dark grey sclerotia on the roots. Seed treatment with abavit failed to arrest the development of these organisms. *F. oxysporum* also vigorously attacked the wheat seedlings but was controlled by abavit. When *Penicillium expansum* and *Cladosporium herbarum* are simultaneously inoculated into wheat seed-grain, the latter gains the upper hand and rapidly suppresses the former. In the case of *C. herbarum* and *T. koningi* the latter is the more active.

P. expansum severely infected cabbage seedlings and was only partially controlled by abavit. In the case of tomato the attacks of the fungus were repelled by healthy seedlings, but those arising from defective seed showed no resistance.

Garrett (S. D.). **Soil conditions and the root-infecting fungi.**—*Biol. Rev.*, xiii, 2, pp. 159–185, 1938.

Following an introductory note on the relation of fungous diseases of plants to the soil environment, the writer summarizes and critically discusses a number of important recent contributions to this subject under the main headings of 'ecology of the root-infecting fungi' and 'component factors of the soil environment in relation to some soil-borne fungus diseases'. Nearly all the work referred to has been noticed from time to time in this *Review*.

Narasimhan (M. J.). **A new sprayer for Arecanut spraying.**—*Mysore agric. Cal. 1938*, p. 7, 1 pl., 1938.

A new apparatus, 'Primus', of the Headland type, for spraying areca palms [*Areca catechu* against *Phytophthora arecae*: *R.A.M.*, xv, p. 77] was recently demonstrated in Mysore. Whereas with the sprayer hitherto used the operator, with the apparatus strapped to his back, has to climb the palm before he can spray the branches, with this Primus sprayer the climber takes with him only a long hose with the result that nearly 1,500 trees can be sprayed per day, as against only 300 trees with two of the old-type sprayers. The cost of the sprayer is about Rs 70, as against about Rs 26 for the old-type, one-gallon sprayer. Attempts are being made to introduce the new sprayers into villages where spraying is carried out on a co-operative basis.

Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1937.—30 pp., 1938.

Monthly observations made on a block of 800 clove trees in Zanzibar since September, 1934, showed that the mortality from the condition known as 'sudden death' [*R.A.M.*, xvi, p. 301] was 83 up to December, 1935, 136 during 1936, and 79 in 1937.

HAMPP (H.). **Prüfung der Peronospora-Bekämpfungsmittel auf dem Hopfenversuchsgut Hüll 1937.** [Trial of Hop *Peronospora* control preparations in the Hüll Hop Experimental Garden in 1937.]—*NachrBl. dtsch. PflSchDienst*, xviii, 4, pp. 30–31, 1938.

The meteorological conditions prevailing in south Germany in 1937 favoured the development of hop downy mildew (*Peronospora*) [*Pseudoperonospora humuli*], trials in the control of which with various new preparations [*R.A.M.*, xvi, p. 773] were continued during that year on the very susceptible Hallertau variety. The only one approaching Wacker's Kupferkalk [included for comparative purposes] in toxicity to the fungus was 'A' ('copper economy mixture'); used at the prescribed strength of 1 per cent., however, it caused scorching, particularly of the umbels, besides being troublesome to prepare. Moderately good results were also obtained with Borchers' Kupferkalk, but the use of three non-copper-containing mixtures tested cannot be recommended. Ob 72 [ibid., xvi, p. 617] showed considerable promise but was used in too few tests for a conclusive judgment as to its merits to be formed.

VARADARAJA IYENGAR (A. V.). **Lime in relation to spike disease of Sandal.**—*Chron. bot.*, iv, 3, pp. 205–206, 1938.

Further investigations into spike disease of sandal [*Santalum album*] in India [*R.A.M.*, xvi, p. 837] demonstrated that the earliest reaction to infection is a disturbed calcium-nitrogen metabolism. The translocation of lime from the roots to the growing points is checked, with the result that the roots of affected plants are rich, and the leaves and twigs poor, in calcium. Nitrogen, on the other hand, rapidly reaches the aerial parts from the roots, causing proliferation of the vegetative organs at the expense of the reproductive. The reduced size of affected leaves is probably due to lime deficiency.

In the affected areas the soil beneath the diseased plants contained twice as much lime as that beneath the healthy plants. Examination during the incubation period of plants predisposed to the disease showed 5 per cent. lime in the dry weight of the leaves with only 1·5 to 2 per cent. nitrogen; such plants always gave an abnormal production of flowers. When plots containing healthy and diseased plants were limed more spike developed than in similar untreated plots.

From these observations it is concluded that the immediate cause of spike is poor intake of calcium by the roots, and growth due to some toxin secreted after infection has become established. The importance of this view is that it serves to connect together the virus and physiological theories of the nature of the disease.

The Australian Sugar Producers' Association Ltd. Annual Meeting and Conference.—*Aust. Sug. J.*, xxx, 1, pp. 7–13, 15–21, 23–29, 31–37, 39–48, 53–55, 57–61, 63–67, 69–73, 75–79, 81–82, 1938.

A. F. Bell, addressing the annual meeting of the Australian Sugar Producers' Association at Brisbane on 21st March, 1938, emphasized the necessity of detailed surveys for the early detection of downy mildew [*Sclerospora sacchari*: *R.A.M.*, xvii, p. 66] and Fiji disease of sugar-cane [ibid., xvii, p. 486 and next abstract]. At least every fourth row of a field should be traversed (every second row in the case of tall cane): the employment of special inspectors for this purpose would necessitate an annual outlay by the Bureau of Sugar Experiment Stations of £20,000, but in the meantime the presence of abnormal stools must be notified by the 8,000 farmers who continually cover their plantations in the normal routine of cultivation. Notwithstanding the publicity given to the recent outbreaks of Fiji disease among the valuable P.O.J. 2878 variety in the Bundaberg area, infection was observed on four further farms during the last survey. Steps are being taken to prohibit the growing of this variety in parts of the Mackay area owing to its susceptibility to downy mildew, and a similar course will have to be followed in Bundaberg unless prompt measures are adopted for the eradication of Fiji disease.

Fiji disease and P.O.J. 2878 in the Maryborough district.—*Aust. Sug. J.*, xxx, 1, p. 5, 1938.

The Bureau of Sugar Experiment Stations has recently been requested to gazette P.O.J. 2878 as an approved variety of sugar-cane for the Bidwell-Magnolia section of the Maryborough district of Queensland, but the application cannot be entertained by reason of the extreme susceptibility of the variety in question to Fiji disease [see preceding abstract]. The disease was first observed in the district in 1926 and reached a climax in 1935; during the past three years the situation has improved but is still far from satisfactory, a number of fields with 10 per cent. or more infection having been observed in the 1937 survey. Much greater use should be made of the resistant Co 290, P.O.J. 213, and P.O.J. 234 varieties. Ultimately the widely grown susceptible 1900 seedling will also have to be disapproved, but hardship would be inflicted by its abolition at the present stage.

HOPKINS (J. C. F.). **A Preliminary list of Rhodesian fungi.**—*Trans. Rhod. sci. Ass.*, xxv, 2, pp. 97–127, 1938.

In this annotated list of 430 Rhodesian fungi (incorporating material collected by the late F. Eyles [cf. *R.A.M.*, v, p. 716]) bibliographical references to the original descriptions of each species are given. Five new species are listed and are furnished with Latin diagnoses, apart from *Phoma caricina* on papaw, which is fully described in a later paper [see above, p. 611].

MILLER (J. H.). **Studies in the development of two Myriangium species and the systematic position of the order Myriangiales.**—*Mycologia*, xxx, 2, pp. 158–181, 4 pl., 1938.

A detailed and fully illustrated account is given of the author's

studies in serial sections of the development of the various organs of *Myriangium duriaei* [*R.A.M.*, xv, p. 216], which is widely distributed throughout the world as a parasite on scale insects on many kinds of trees, and of *M. curtisii* Mont. & Berk., which, judging from the literature, is confined to the southern United States as a parasite of scale insects on various trees. The investigation was undertaken with a view to throwing some light on the correct position for *Myriangium* and related forms in the Ascomycete system, which has been variously interpreted by different authors. In his opinion, the families of the Myriangiales show progressive development in stroma and definition of the fruiting body beginning with the Elsinoeae, through the Plectodiscelleae, the Myxomyriangiaceae, and finally the Myriangiaceae. In a natural system they should be placed next to the Plectascales; the present tendency to align them with the Pyrenomycetes is untenable, as none of them produces perithecia or has the internal arrangement of members of that family.

Lepik (E.). **Beiträge zur Nomenklatur der Ostbaltischen Pilzflora III.** [Contributions to the nomenclature of the East Baltic fungus flora III.]—*Mitt. phytopath. VersSta. Univ. Tartu* 47, pp. 226–242, 2 pl., 1938.

This is a critically annotated list with revised nomenclature of Dietrich's second 'century' of East Baltic cryptogamic fungi, published at Reval in 1853, of which three copies, in a fair state of preservation, are stated to be available in Estonia.

Rick (J.). **Monografia das Poliporineas riograndenses.** [Monograph of the Polyporineae of the Rio Grande.]—*Broteria*, vii, 1, pp. 5–21, 1938.

Latin and Portuguese descriptions are given of 38 Polyporineae, including two new species, from the Rio Grande, Brazil [cf. *R.A.M.*, xvii, p. 348].

Yen (W. Y.). **Germination des spores de quelques Ustilaginées.** [Germination of the spores of some Ustilagineae.]—*Bull. Soc. mycol. Fr.*, liii, 3–4, pp. 339–345, 4 figs., 1938.

Notes are given on the spore germination of the following smuts, viz., *Ustilago olivacea* found on *Carex riparia* in France, *U. olivacea* var. *macrospora* n. var. found on *C. cladostachya* in Costa Rica, *U. scolymi* on *Scolymus hispanicus* in Spain, and *Sphacelotheca* [*U.*] *panici-miliacei* [*R.A.M.*, xvi, p. 26] found on *Panicum miliaceum* in Rumania.

In Czapek's liquid medium the spores of *U. scolymi* give rise to a generally 4-celled promycelium 30 to 37·2 by 3·6 to 6 μ, with oblong, elongated sporidia 9·6 to 18 by 2·4 to 3·6 μ, which multiply rapidly by budding on the surface of the medium. One spore may give rise simultaneously to two promycelia in the same or opposite directions, which later produce true sporidia. Sometimes the sporidia may form before the promycelium becomes septate. Very occasionally, several sporidia are formed simultaneously at the level of a septum, while the remaining cells of the promycelium are still sterile.

Material of *U. panici-miliacei* kept in the herbarium for five years

showed a very small percentage germination of the spores on carrot juice and liquid beer wort media. It was found that the four promycelial cells generally give rise to true sporidia which either bud or emit thin, branched hyphae; the germinative characters are identical with those of *U. hordei.*

MATSUMOTO (T.). **An unusual mode of transmission of a certain Tobacco virus disease somewhat closely related to leaf curl or kroepoek.**—*Trans. nat. hist. Soc. Formosa*, xxviii, 176, pp. 123–137, 2 pl., 1938.

The author announces the discovery of a new dwarf disease of Virginian tobacco on young plants in pots and seed-beds. The disease, which is stated to be very serious, especially in seedlings, is caused by a virus and closely resembles leaf curl or 'kroepoek' [*R.A.M.*, xvii, p. 416], except for the absence of enations. The diseased plants are much dwarfed and the leaves, which are also reduced in size, are rolled downwards along the margin, more or less thickened, and very brittle. The upper surface of mature leaves is dark green, more or less ribbed, and slightly wrinkled, the lower surface yellowish-green and very glossy. The upper immature leaves are chlorotic, the secondary veins somewhat thickened, and the flower buds, if produced, are underdeveloped and more or less bleached. In 21 experiments on the transmission of the disease the author found that tobacco planted in soil in which diseased plants had previously been grown did not contract infection, that a limited amount of infection resulted from rubbing healthy leaves with diseased ones, and that the disease was easily transmitted when leaves of healthy and diseased plants were kept either in direct contact or at a distance of not more than 5 to 10 cm. apart, even when screens of wire gauze or glass plates were interposed. The author suspects that some form of air transmission is involved [but in a supplementary note on p. 256 of the *Journal* states that mites were found on the plants and their occurrence must be taken into consideration].

CLAYTON (E. E.), SMITH (H. H.), & FOSTER (H. H.). **Mosaic resistance in Nicotiana tabacum L.**—*Phytopathology*, xxviii, 4, pp. 286–288, 1 fig., 1938.

Attention is drawn to the existence of certain genetic factors modifying the expression of the two genes conferring resistance to tobacco mosaic [*R.A.M.*, xvii, p. 417], and apparently apt to give rise to erratic behaviour in back-crossing experiments, as in 1937, when 23 F_2 populations derived from the second back-cross of resistant selections to susceptible parent varieties yielded only two-thirds of the expected number of resistant plants. Three indications of the existence of such modifying factors are available, namely, (1) the decreasing proportion of typical resistant plants in the F_2 after the second back-cross to the susceptible parent, due to the accumulation of genes reducing resistance from class 1 (none or very faint markings) to 2 (distinct diffuse spotting) or 3 (mild systemic mottling); (2) the tendency of resistant F_2 Ambalema selections crossed with susceptible varieties to segregate for classes 1, 2, and 3 in the F_3; and (3) the varying degrees of resistance found in the collections from Colombia all of which possessed the two major

recessive genes for resistance. It is obvious that the existence of genes modifying the normal expression of mosaic resistance presents a serious problem in the development of a breeding programme entailing frequent back-crosses to the susceptible parent.

MILLER (P. R.). **Serum diagnosis of virus diseases of Tobacco.**—*Plant Dis. Reptr*, xxii, 5, pp. 74–77, 1938. [Mimeographed.]

Further tests carried out in 1937 with K. S. Chester's serological method of identifying tobacco virus diseases [*R.A.M.*, xvi, p. 767] showed that it readily enabled mosaic diseases to be detected, but with other virus diseases the amount of tobacco juice required was so large that it prevented a clear vision of the reaction. In yet other experiments on 64 different tobacco mosaic selections [see next abstract] it was noted that there appeared to be some relation between the type of reaction obtained and the depth of the precipitate. Only one selection, 12316, completely failed to react to the mosaic serum, but selections 12304, 12311, and 12360 reacted so faintly that the reactions should probably be regarded as negative. With other sera, e.g., ring spot, veinbanding, etch, aucuba mosaic, and latent mosaic, the reaction was obscured by the excessive amount of plant material present in the tested juice. It is concluded that this method of diagnosis is highly satisfactory for mosaics, but needs to be modified in some way so that the juice can be cleared of extraneous matter before it can be adapted for field use with other virus diseases.

VALLEAU (W. D.) & DIACHUN (S.). **Tests of strains of Tobacco mosaic virus with Chester's field test.**—*Plant Dis. Reptr*, xxii, 5, pp. 77–81, 1938. [Mimeographed.]

Field tests on 64 strains of tobacco mosaic with K. S. Chester's serological method of identification [see preceding abstract] were carried out in Kentucky, using the fourth leaf in the growing point, generally a well-developed one from which the required amount of juice could easily be squeezed. The results obtained [which are tabulated] showed that certain strains which were not inactivated by drying, and appeared to be typical tobacco mosaics in the field and greenhouse, failed to react. The test gave positive results with most of the strains, but cannot be considered as accurate a method for identifying the viruses at present classed as common or ordinary field mosaic as is the drying test in which leaves dried for 30 days are powdered, mixed with water, and used as inoculum on test plants.

MARTIN (L. F.), BALLS (A. K.), & MCKINNEY (H. H.). **The protein content of mosaic Tobacco.**—*Science*, N.S., lxxxvii, 2258, pp. 329–330, 1938.

A method has been developed of distinguishing between trypsin-resistant tobacco mosaic virus protein [*R.A.M.*, xvii, p. 273] and normal proteins without resorting to extraction of the tissue. The procedure involves the determination of total nitrogen and nitrogen soluble in 10 per cent. trichloracetic acid, the latter before and after digestion with commercial trypsin.

Results were obtained by this method in co-operative experiments

by the Food Research Division, Bureau of Chemistry and Soils and the Division of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, on three tobacco varieties (Wisconsin-Havana, Ambalema, and 448A) and three strains of tobacco mosaic (common, mild, and yellow). Wisconsin-Havana reacted to inoculation with common mosaic by a severe pale green mottling, to yellow mosaic by pronounced yellow mottling, and to mild mosaic by mild light green mottling. No symptoms were induced in Ambalema or 448A by common mosaic. The total nitrogen and protein contents of the infected plants underwent very little change in comparison with the normal, irrespective of the severity of the disease. In the case of common mosaic the trypsin-resistant protein, believed to represent virus protein, exists in a smaller proportion than hitherto supposed, though the amount was higher in Wisconsin-Havana (up to 1·10 mg. per gm.) than in the other less susceptible varieties. There is at present no evidence that the yellow mosaic virus is resistant to trypsin.

VAN DER POEL (J.). **Overzicht van de thans verkregen resultaten bij het onderzoek naar den invloed van verschillende meststoffen op de slijmziekte.** [Survey of the results hitherto obtained in the investigation on the influence of various fertilizers on slime disease.] —*Meded. Deli-Proefst.*, Ser. 2, xcix, 31 pp., 1938. [English summary.]

In further experiments to determine the influence of fertilizers on slime disease (*Bacterium solanacearum*), tomatoes (which are stated to be even more susceptible than tobacco in Sumatra [*R.A.M.*, xvii, p. 416]) were grown in zinc trays in infected alluvial sandy loam soil with the addition of various nutrient substances.

Low-grade superphosphate (1,000 mg. [? P_2O_5] per tray of 1,200 gm. soil containing 25 seedlings) gave the best results in the phosphate series of tests, reducing the incidence of infection from $38\pm4{\cdot}5$ and $75\pm6{\cdot}0$ to $2\pm0{\cdot}8$ and $13\pm2{\cdot}8$ per cent., respectively, in two experiments. High-grade superphosphate and basic slag were less uniformly effective, while dicalcium phosphate and ground rock phosphate produced no appreciable improvement. The incidence of infection was also greatly reduced by mixtures of low-grade superphosphate and ammonium sulphate, gypsum (believed to be the active component of low-grade superphosphate in respect of slime disease control), high-grade superphosphate and ammonium sulphate, acetate of lime and ammonium sulphate, high-grade superphosphate and potassium sulphate, and calcium chloride and potassium sulphate. Potassium sulphate alone or with magnesia is effective against slime disease only when applied in heavy doses (1,000 mg. K_2O per tray). Groundnut meal (2 gm. per tray) reduced the amount of slime infection by 50 per cent.

In a field trial seven plots without groundnut meal received per hect. 300 kg. urea, 360 kg. 36 per cent. high-grade superphosphate, and 1,080 kg. tobacco stalk ash, while seven with groundnut meal were given 2,100 kg. groundnut meal, 720 kg. high-grade superphosphate, and 1,080 kg. tobacco stalk ash. In 1932 the percentages of diseased plants on the two series of plots were 69·4 and 68·9, respectively; in

1936 the numbers of dead plants after 60 days in the urea and meal plots were 32·4 and 15·9 per cent., respectively.

The results of experiments with different forms of nitrogen showed nitrates to be more effective than ammoniacal compounds in the control of slime disease, which is also favourably influenced by the use of ground *Mimosa invisa* stems as manure. The admixture of ground *Macaranga denticulata* leaves caused a 12 per cent. reduction of *Bact. solanacearum*, which was increased to 43 per cent. by the addition of nitrogen, the corresponding figures for ground *Imperata cilindrica* foliage with and without nitrogen being 16 and 46 per cent., respectively. Sugar, starch, or cellulose, combined with guano (200 mg. nitrogen, 400 mg. phosphoric acid, and 250 mg. potash per tray), noticeably reduced the incidence of slime disease, while a beneficial action was also exerted by starch and ammonium sulphate. Presumably the use of organic compounds as fertilizers encourages organisms in the soil microflora antagonistic to *Bact. solanacearum*, which is suppressed [cf. ibid., xv, p. 395].

Van der Weij (H. G.). **Overzicht van de ziekten en plagen der Deli-Tabak in het jaar 1937. A. Ziekten der Tabak.** [Report on the diseases and pests of Deli Tobacco in the year 1937. A. Tobacco diseases.]—*Meded. Deli-Proefst.*, Ser. 2, 98, pp. 3–9, 1938.

During 1937 it was necessary to break up 57,604 tobacco seed-beds in the Deli district of Sumatra on account of slime disease (*Bacterium solanacearum*) [*R.A.M.*, xvi, p. 413; xvii, p. 490 and preceding abstract], the corresponding number for the previous year being 55,406. The average incidence of infection in the field was 10·7 per cent. (10·3 in 1936). The disease assumed a serious form in mature plants, producing the so-called 'long kong' or hollow stem effect.

Phytophthora [*parasitica*] *nicotianae* necessitated the clearance of 1,310 seed beds as compared with 295 in 1936. The loss of leaves in the field was estimated at 1,500,000. *Cercospora nicotianae* was again responsible for heavy damage on most of the 47 estates under observation.

Mosaic also caused extensive injury in 22 plantations. Rotterdam B disease [ibid., xvi, p. 129] and 'gilah' [identical in part with leaf curl: see above, p. 629] were also prevalent, the former being present on 28 and the latter on 35 estates. 'Daon lidah' [*R.A.M.*, xvii, p. 416] or 'pointed leaf' appears to be a composite name for a group of obscure pseudo-mosaic disorders and is reported from 12 plantations.

Notes are also given on some non-parasitic and climatological disturbances and on certain troubles occurring during the processes of curing and fermentation.

Fourmont (R.). **Un Ascochyta parasite du Tabac.** [An *Ascochyta* parasitic on Tobacco.]—*Rev. Path. vég.*, xxv, 2, pp. 119–134, 5 figs., 1938.

From tobacco growing near Bordeaux and showing irregular, oval lesions on the stem, over which the bark was raised, cracked, and silver white, the author isolated a species of *Ascochyta* and a *Coniothyrium*; the latter was found to be saprophytic.

Glasshouse inoculations with the former fungus on previously wounded leaves of *Nicotiana rustica* gave lesions 2 cm. in diameter in three weeks; the affected tissues turned black, dried up, and became perforated, leaving a brown edge. Needle-prick inoculations of unwounded leaves of five-months-old Paraguayan tobacco (*N. tabacum* var. Paraguay) three weeks later gave lesions 1 cm. in diameter, membranous, often perforated in the centre, and bordered by a discoloured zone, this being the usual appearance of the spots after infection of unwounded leaves. *N. glutinosa* was more rapidly and extensively attacked. On unwounded stems of *N. petiolaris* elongated, superficial spots appeared, while on wounded stems the tissues were destroyed as far as the centre, and the edges of the necrosed parts became covered with pycnidia. Inoculations of the unwounded leaves of potato, tomato, and beetroot also gave positive results.

Field inoculations made at the end of July by placing a fragment of culture on unwounded leaves of Paraguayan tobacco and *N. glauca* caused necrosis of the tissues, which turned brown and became surrounded by a discoloured margin; on wounded leaves the necrosis was followed by perforation. On unwounded stems of Paraguayan tobacco, Hungarian tobacco (*N. tabacum* var. Hongrie) and *N. alata* irregular, oval spots appeared, generally at intervals of 5 or 6 cm. along the length of the stem; occasionally one long, narrow, superficial lesion was formed. When the fungus was inserted in cuts made in the stems of Paraguayan tobacco it destroyed the cut surfaces, enlarging the wound, and spreading to the medulla. On *N. glauca* the stems turned black round the wounds, and the edge of the affected areas became violet. Crevices developed, and the wounds became confluent, though some cork formation took place later.

Experimental evidence showed that the fungus grew best at about 22° C., was not killed by exposure to 0°, and that the thermal death point lay between 35° and 41°.

The fungus, which is named *A. ducometii* n. sp. [with a Latin diagnosis], is characterized by round, rather flat, brown, ostiolate pycnidia measuring 100 to 230 by 75 to 220 (average 140 by 125) μ, and oblong-ovoid or subcylindrical, continuous, later uniseptate, not constricted, hyaline spores, 5·2 to 8·2 by 2·8 to 3·8 (average 3 by 7) μ.

Ainsworth (G. C.), Oyler (Enid), & Read (W. H.). **Observations on the spotting of Tomato fruits by Botrytis cinerea Pers.**—*Ann. appl. Biol.*, xxv, 2, pp. 308–321, 2 pl., 2 figs., 1938.

The symptoms of spotting of field and glasshouse tomatoes caused, as recently demonstrated [*R.A.M.*, xvi, p. 728], by *Botrytis cinerea*, consist of minute, brownish punctures in the centre of pale green or silver-coloured spots, 0·2 to more than 0·5 cm. in diameter, which increase in size as the fruit swells and occur more frequently at the calyx end of the fruit, although occasional severe spotting of the blossom end has been observed. There is often a slight swelling round the centre of the spot. Several series of experiments showed that spotting was favoured by high humidity; that resistance to *B. cinerea* increased with the growth of the fruit (correlated with increase in thickness of the epidermal cell wall); and that fruit on the plant was more easily

spotted than similar detached fruit, which is tentatively explained by the greater turgidity of the fruit on the plant. The experimental data suggest that the air-borne spores of *B. cinerea* germinate on the surface of immature tomato fruits under temporary conditions of high humidity, penetrate the epidermis, and form the spots by the action of pectinase secreted by the germ tubes, but that the sporelings die with the return of drier conditions so that no fungus can subsequently be isolated from mature spots. Similar spots were experimentally produced by other species of *Botrytis*, but not by other fungi capable of attacking tomatoes. The *Botrytis* spot is compared with the injury caused by *Myzus convolvuli* [*Macrosiphum solani*], for which the name stigmonose, applied by Bewley in 1923 to Aphid damage of tomato, is retained [ibid., xvi, p. 421], and the differences in symptoms are pointed out. It is suggested that the use of the best horticultural practice will effectively remove the two main sources of *Botrytis* spotting: excessive humidity and the presence of *Botrytis* spores harboured by infected plant debris. Fumigation is recommended against stigmonose.

[An abridged account of these studies by the two first-named authors was published in *Gdnrs' Chron.*, cii, pp. 380–381, 2 figs., 1937.]

Bond (T. E. T.). **Infection experiments with Cladosporium fulvum Cooke and related species.**—*Ann. appl. Biol.*, xxv, 2, pp. 277–307, 2 pl., 16 figs., 1938.

The author describes the symptoms and the histology of infection by *Cladosporium fulvum* causing leaf mould on tomato [*R.A.M.*, xvii, pp. 140, 419]. The hyphae of the fungus are shown to penetrate the host through the stomata without forming any appressoria or other modifications, the frequency of penetration being far greater at a humidity fluctuating from saturation point to 85 per cent. than at constant saturation. It is suggested that the penetration is at least partly controlled by a hydrotropic stimulus. The mycelium is intercellular and without haustoria, developing normally only as long as the host cells are alive, and its initial rate of spread within the host is slower in the basal region of the plant than in the middle, and in the variety Maincrop than in Giant Red. Normal stomatal penetration was observed in a wide range of immune and 'inappropriate' hosts, but symptoms of infection occurred only in the varieties of *Lycopersicum esculentum*, in *L. humboldtii*, and in two strains received as *L. racemigerum*, which are apparently more closely related to the cultivated than to the true currant tomato (*L. pimpinellifolium*: syn. *L. racemigerum*). In the last-named the mycelium is also shown to be intercellular and without haustoria; it produced no conidiophores and appeared to remain alive in the leaf for a considerable period, becoming more restricted in its spread with the advancing age and relative maturity of the leaf. No external symptoms of infection were observed and only isolated cells in immediate contact with the hyphae became necrotic. Essentially similar observations were recorded for species of *Solanum*, *Hyoscyamus*, *Nicotiana*, and *Schizanthus*, while on other Solanaceae and in plants belonging to the Scrophulariaceae, Compositae, and Cucurbitaceae an extensive growth of mycelium was observed. The study of *C. cucumerinum*, which is pathogenic to the fruits and foliage of cucumber and to

the young shoots of *Bryonia dioica*, and *C. herbarum*, which is not considered to be a potential parasite of the plants inoculated, revealed a behaviour apparently identical with that of *C. fulvum* in the following respects: stomatal penetration by unaltered germ-tubes, intercellular mycelium without haustoria, typical for infection of foliage; and the formation of conidiophores of subepidermal origin. It is suggested that these features may prove characteristic of the genus *Cladosporium* as a whole.

BAXTER (D. V.). **Some resupinate Polypores from the region of the Great Lakes. IX.**—*Pap. Mich. Acad. Sci.*, xxiii, pp. 285–305, 9 pl., 1938.

In this paper [cf. *R.A.M.*, xvi, p. 788] the author states that the programme of research dealing with the resupinate Polypores of North America comprises the transfer of between 1,200 and 1,500 cultures annually, and the addition of new isolations from different substrata, new species, and previously recorded hosts which have been obtained from other regions, to the existing collections. Descriptions of twelve species of *Poria* are given, among them four new ones and several forms rare to North America. The characteristics of ten resupinate Polypores in culture are discussed and tabulated.

HIRT (R. R.). **A progress report on laboratory tests of the relative durability of different varieties of Black Locust to certain wood decay fungi.**—*J. For.*, xxxvi, 1, pp. 52–55, 1938.

In comparative tests under controlled conditions at the New York State College of Forestry on the relative resistance of blocks of the common black locust (*Robinia pseud-acacia*) and the shipmast locust (*R. pseud-acacia* var. *rectissima*) from Long Island to pure cultures on nutrient agar of *Polyporus robiniophilus* (Murr.) Lloyd, *Fomes rimosus* [*R.A.M.*, xiv, p. 62], *F. igniarius* [ibid., xvii, pp. 12, 358], and *Poria incrassata* [ibid., xiv, p. 276], the mycelia of the fungi grew with equal profusion over both species of locust, except in the case of *Polyporus robiniophilus* which was definitely more scanty on the shipmast variety than on *R. pseud-acacia*. After five months the latter was discoloured and decayed by all the fungi, the wood attacked by *Poria incrassata* being deep brown, cracked, and very brittle, while the other organisms induced a bleached effect. *R. pseud-acacia* var. *rectissima* was slightly rotted only by *P. incrassata* (2·31 per cent. loss of weight compared with 33·32 per cent. (averages) for black locust infected by the same fungus). The weight losses in *R. pseud-acacia* caused by *Polyporus robiniophilus*, *F. igniarius*, and *F. rimosus* were 3·99, 2·24, and 8·63 per cent., respectively.

COLLINS (D. L.). **Feeding habits of Scolytus multistriatus Marsham with reference to the Dutch Elm disease.**—*J. econ. Ent.*, xxxi, 2, pp. 196–200, 2 diags., 1938.

Extreme variation was observed in the range and extent of feeding by the bark beetle, *Scolytus multistriatus*, in the crotches of elm twigs in New York State. Observations made on over 500 trees, involving the examination of more than 100,000 crotches, indicate that the presence of wood which is either attracting or producing beetles in or

near a given tree renders that individual more liable to feeding attacks. The exact value of spraying as a control measure against *S. multistriatus* remains doubtful, but it is becoming increasingly clear that the removal of injured, dying, and dead elm wood should not only assist in the extermination of the beetles by destroying their breeding places, but also help to reduce the spread of Dutch elm disease [*Ceratostomella ulmi*: *R.A.M.*, xvii, p. 568] by minimizing the attraction of healthy trees for possibly contaminated insects.

GOIDÀNICH (G.). **Notizie sulle ricerche di selezione di Olmi resistenti alla grafiosi.** [Notes on researches in the selection of Elms resistant to graphiosis.]—*Ital. agric.*, lxxv, 1, pp. 69–74, 4 figs., 1938.

In recent inoculation experiments in Italy to determine the reaction of certain elm selections to graphiosis [*Ceratostomella ulmi*: *R.A.M.*, xvi, pp. 353, 844], *Ulmus campestris*, though susceptible in general, was found to include a number of resistant individuals characterized by various structural peculiarities; the behaviour of *U. montana* was variable; *U. laevis* and *U. pumila* [see next abstract] were resistant; *U. americana* proved to be highly susceptible; and a high degree of resistance was shown by the 'C. Buisman' elm grafted on *U. hollandica* or *U. pumila*. In small-scale tests with exotic varieties of minor importance *U. laciniata nikkoensis* was resistant.

WOLLENWEBER (H. W.) & RÖDER (K.). **Das Verhalten einer Pfropfulme (Ulmus pumila) gegen Graphium ulmi.** [The reaction of a grafted Elm (*Ulmus pumila*) towards *Graphium ulmi*.]—*NachrBl. dtsch. PflSchDienst*, xviii, 4, pp. 31–32, 1 fig., 1938.

Somewhat disappointing results, both as regards growth habit and reaction to *Ceratostomella ulmi*, were obtained in further experiments at the Biological Institute, Berlin-Dahlem, in the grafting of scions of the reputedly resistant *Ulmus pumila* on stocks of the susceptible native species commonly used for street planting [*R.A.M.*, xvi, p. 844]. Inoculation experiments with the fungus on the grafted crown resulted in the development of the typical elm disease symptoms, including cigar-shaped rolling of the leaves and distortion of the branch tips, followed by complete defoliation after ten weeks. *C. ulmi* was isolated from the discoloured vascular tissues of an infected branch. Similar objections would in all probability apply to another Asiatic species, *U. pinnato-ramosa*, but tests are planned to determine the value for grafting purposes of the Spanish selection, *U. foliacea* No. 24 (Christine Buisman elm), promising results with which are reported from Holland [and see preceding abstract].

PETRAK (F.). **Beiträge zur Kenntnis der Gattung Hercospora mit besonderer Berücksichtigung ihrer Typusart Hercospora tiliae (Pers.) Fr.** [Contributions to the knowledge of the genus *Hercospora* with special reference to its type species *Hercospora tiliae* (Pers.) Fr.]—*Ann. mycol., Berl.*, xxxvi, 1, pp. 44–60, 1938.

Having detected considerable confusion in the identification of herbarium material commonly labelled *Sphaeria tiliae*, the author, on the

basis of observations and a thorough investigation of the position, shows that three Pyrenomycetes occur on lime (*Tilia*) branches in Czechoslovakia, viz., *Hercospora tiliae* (Pers.) (*S. tiliae*), with its conidial stage *Rabenhorstia tiliae*; *Melanconis desmazierii* Pet., conidial stage *Melanconium desmazierii* (B. & Br.) Sacc.; and *Diaporthe hranicensis* Pet., conidial stage *Amphicytostroma tiliae* (Sacc.) Pet. Of these only the first-named may possibly assume a parasitic character in conjunction with *Exosporium tiliae* and *Pseudomassaria chondrospora*.

Full descriptions are given of *H. tiliae*, *Melanconis desmazierii*, and *D. hranicensis*. *H. tiliae* is characterized by eutypelloid stromata, the ostioles emerging singly and rarely projecting above the stromatal apex, cylindrical, short-stalked asci with oblong or elongated-ellipsoid, frequently fusiform spores, 12 to 18 by 6 to 8 μ, average 15 by 7 μ, and numerous paraphyses. A new form of *H. tiliae*, f. *gigantea*, characterized by perithecia 450 to 600 μ in height and 300 to 400 μ in breadth (200 to 400 μ in diameter in *H. tiliae*), is also described.

LINDEGG (GIOVANNA). **Note fitopatologiche. II. Una nuova specie di 'Coryneum' su rametti di Tiglio.** [Phytopathological notes. II. A new species of *Coryneum* on *Tilia* branches.]—*Riv. Pat. veg.*, xxviii, 3–4, pp. 69–74, 1 fig., 1938.

In 1936, ten- to twelve-year old basswood [*Tilia americana*] trees at Piacenza, which for the previous two or three years had shown yellowing of a few leaves accompanied by a withering of some of the young branches, suddenly developed much more severe symptoms, including extensive yellowing, heavy leaf fall, a brown discoloration of the young shoots, and a drying-up of both young and old branches. In some cases, even the trunks showed incipient desiccation and later on succumbed. The roots were entirely healthy. The European species of *Tilia* in the vicinity were unaffected.

From livid or ash-coloured, irregular, depressed lesions surrounded by a conspicuous, dark reddish border, in the bark of the affected branches the author isolated a fungus with minute, black, erumpent acervuli, olivaceous-brown, cylindrical, pluriseptate conidiophores measuring 60 to 75 by 8 μ, and ovoid, olivaceous-brown, generally 3-septate conidia rounded at the edges, faintly constricted at the septa, and measuring 40 by 15 μ. The fungus is named *Coryneum tiliaecolum* Ferraris & Lindegg n. sp. [with a Latin diagnosis]. No inoculation experiments with the fungus are described but the author considers it to be the cause of the disease. Affected trees recovered after removal of the infected branches and two applications shortly after leaf-fall of a 4 per cent. cupric spray.

MERENDI (A.). **Il problema dei Castagneti da frutto in Toscana.** [The problem of the edible Chestnut in Tuscany.]—*Atti Accad. Georgof. Firenze*, Ser. 6, iv, pp. 41–77, 1938.

Among other problems relating to the production and utilization of edible chestnuts in Tuscany, the writer deals with the present distribution and position of the ink disease due to *Phytophthora cambivora*, and with the possibilities of arresting its further spread by the extended

cultivation of the Shiba and Tamba varieties of the Japanese chestnut (*Castanea crenata*) [*R.A.M.*, xvii, p. 356].

Petrak (F.). **Beiträge zur Systematik und Phylogenie der Gattung Phaeocryptopus Naoumov.** [Contributions to the taxonomy and phylogeny of the genus *Phaeocryptopus* Naoumoff.]—*Ann. mycol., Berl.*, xxxvi, 1, pp. 9–26, 1938.

This is a critical discussion, supplemented by an amended generic diagnosis in German, of the taxonomy and phylogeny of Naoumoff's genus *Phaeocryptopus* (*Bull. Soc. oural. Sci. nat.*, xxxv, p. 20 extra, 1915) [cf. *Bull. Soc. mycol. Fr.*, xxx, pp. 424–425, 3 figs., 1914] represented by three species, viz., *P. nudus* (Peck) Pet. [? n. comb.], syn. *Asterina nuda* Peck (1885), *P. abietis* (Naoumoff's type), *Adelopus balsamicola* [*R.A.M.*, xvi, p. 719], and *A. nudus* [ibid., xvi, p. 356], on dying and dead needles of various *Abies* spp., especially *A. balsamea* in North America, *A. sibirica* in the U.S.S.R., and *A. alba* in Europe; *P. gaeumanni* (Rohde) Pet. [? n. comb.] (*Adelopus gaeumanni* [ibid., xvi, p. 356; xvii, p. 361], and *A. balsamicola* f. *douglasii* [ibid., xvi, p. 719]) on living and dying needles of *Pseudotsuga taxifolia* in Austria, Germany, Switzerland, and England; and *P. pinastri* (Ell. & Sacc.) Pet. [? n. comb.] (syn. *Asterina pinastri* Ell. & Sacc.) on dried needles of *Pinus rigida* in the United States.

Phaeocryptopus gaeumanni is characterized by a profuse, reticulate, more or less closely interwoven, pale grey to olive-brown, indistinctly and distantly septate mycelium, 3–5 μ thick, traversing the entire mesophyll of the infected Douglas fir needles, here and there forming small knots enclosing red to rust-coloured vestiges of the host tissues, and partially occluding the stomatal air-chambers. The obtusely conical hypostromata measure 20 to 35 μ in thickness at the site of penetration and taper downwards to an average of 9 to 15 (8 to 22) μ. The roughly circular, dull black, densely aggregated perithecia, strongly convex at the apex, sometimes irregular, very seldom slightly elongated and broadly ellipsoid, measuring 50 to 80 μ in diameter, are furnished with a membrane 13 μ in thickness, composed of two to three layers of nearly opaque, brownish-black cells, merging abruptly into the hyaline internal tissue, and contain clavate, sessile or very short-stalked, thick-walled asci, 30 to 40 by 8 to 15 μ, containing eight elongated-clavate or fusiform, straight or sometimes slightly curved, uniseptate, hyaline, bi- or triseriate ascospores, 11 to 15 by 3·5 to 5 μ. Paraphysoids are sparingly represented by a mucilaginous mass showing only a faintly fibrous structure.

From a careful examination of abundant material of the fungus in question, the writer upholds Rohde's opinion that *P. gaeumanni* is distinct from *P. nudus* [ibid., xvi, p. 356], as against that of Steiner [ibid., xvi, p. 719], who regards the former as merely a variant of the latter. This conclusion is reached mainly on the basis of marked differences between the two fungi in respect of hypostromatal development and the shape and dimensions of the perithecia.

Kimmey (J. W.). **Susceptibility of Ribes to Cronartium ribicola in the west.**—*J. For.*, xxxvi, 3, pp. 312–320, 1938.

Tests of the susceptibility to *Cronartium ribicola* and teleutospore-

producing capacity of *Ribes* spp. [*R.A.M.*, xvii, p. 572] have been carried out over a period of 15 years in British Columbia and Oregon, involving a total of 22,046 trials on 51 *Ribes* spp. and forms. Whenever possible the experiments were conducted on naturally grown *Ribes* exposed to infection from adjacent white pines [*Pinus monticola*] producing an abundance of aecidiospores, but where this was impracticable epidemic conditions were simulated by artificial inoculations. California and southern Oregon species were transplanted in test plots within the known range of the disease to prevent the introduction of the rust into unaffected areas. The test plants of each *Ribes* sp. were classified as open, part-shade, or shade forms and the data relating to each were kept separate throughout the study. The various species and forms are listed in tabular form in order (1) of their susceptibility to infection, and (2) of their capacity for teleutospore production.

Generally speaking, the more susceptible the species or form the heavier was teleutospore production and vice versa. In most cases, within a single species, the part-shade form was the most susceptible and usually produced the largest number of teleutospores, while the open form was the most resistant and produced the fewest teleutospores. Of the species tested, *R. nigrum* was the most susceptible and produced the highest number of teleutospores, while the open form of *R. cereum* was the most resistant and yielded the fewest teleutospores. Other susceptible species included *R. klamathensi*, *R. marshallii*, *R. cruentum*, *R. binominatum*, *R. velutinum*, *R. erythrocarpum*, and the Oregon Caves variety of *R. sanguineum*, but their position in the scale can only be tentative since they were tested outside their natural range. Some degree of resistance was shown by *R. divaricatum* (open form), *R. lacustre*, *R. setosum*, *R. viscosissimum*, *R. laxiflorum*, *R. lobbii*, *R. acerifolium*, *R. americanum*, and cultivated red currants and gooseberries (unnamed). Occasional infections were found on the fruits and floral bracts of *R. sanguineum*, while teleutospores have been observed on the peduncles of *R. lacustre* and *R. sanguineum* and on the rachides of *R. petiolare*. No infection resulted from the inoculation of bud scales and unopened buds of *R. lacustre*, *R. petiolare*, and *R. viscosissimum* with aecidiospores of *C. ribicola*.

MANDENBERG (E. C.). **History of blister-rust control in Michigan.**— *Pap. Mich. Acad. Sci.*, xxiii, pp. 311–318, 1938.

This is a detailed survey of work carried out under a co-operative control scheme against white pine blister rust [*Cronartium ribicola*: see preceding abstract] in Michigan before and after the enactment of the State blister rust control law [*R.A.M.*, ix, p. 8]. The history of the occurrence of the disease in Michigan is given, and the control measures, comprising pre-eradication survey of all white pine stands in the autumn and winter, eradication of all *Ribes* spp. under white pine and within a 900 ft. zone round the stands, and nursery sanitation, are described. A list of the *Ribes* spp. found is given and stress laid on the eradication of *R. nigrum*, the cultivated black currant, which is highly susceptible to the rust and particularly dangerous in the long-distance spread of infection.

GOBIET (M.). **Les causes du dépérissement du Mélèze d'Europe.** [The causes of the failure of European Larch.]—*Bull. Soc. for. Belg.*, xlv, 4–5, pp. 191–202, 1938.

After pointing out that the European larch has proved a failure in Belgium, and that it is being replaced by Japanese varieties which lack the height and other desirable qualities of the former, the author states that the failure of the trees has been due to insect and fungal diseases, chiefly canker. He takes the view that canker is brought about mainly by frost injury, not primarily by *Dasyscypha calycina* [*D. willkommii*: *R.A.M.*, xiii, p. 482; xv, p. 618; xvii, p. 360]. Recent work on the disease in various countries is reviewed and discussed, and the conclusion is reached that the solution of the problem in Belgium is to select varieties of the European larch suitable for the local climatic conditions of the districts in which they are to be planted.

BUCHWALD (N. F.). **Steril gulvlægning.** [Sterile floor-laying.]—*Dansk Skovforen. Tidsskr.*, xxii, pp. 260–265, 1937. [Received July, 1938.]

Of late years there is stated to have been an alarming increase of fungal rotting in new buildings in Denmark, due in part to the use of insufficiently dried timber for constructional purposes and partly to the extensive replacement of the old-fashioned stoves by central heating, which has not the same drying effect. Formerly *Merulius lacrymans* was the chief agent of dry rot—and still is in old houses—but it has been largely superseded in modern buildings by *Paxillus acheruntius* [*P. panuoides*: *R.A.M.*, xvi, p. 789], first recorded in Denmark in 1918, and *Coniophora cerebella* [*C. puteana*: ibid., xvii, pp. 424, 496 *et passim*]. Control may be effected by flaming all the flooring boards, joists, and the like, with a blow-lamp to destroy the fungal spores, followed by the application of a disinfectant to prevent any subsequent development of the organisms. Cuprinol [ibid., xv, p. 413] may be applied to beams but its strong odour disqualifies it for indoor treatments, which should be made with 4 per cent. copper sulphate or Bordeaux mixture, or better still with antinonnin [ibid., xiii, pp. 414, 486], if procurable.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xii, 4, pp. 81–83, 1938.

Kenya (Colony and Protectorate of). By Ordinance No. XXIV of 1937, dated 28th August, 1937, which may be cited as the Plant Protection Ordinance, 1937 [cf. *R.A.M.*, xvii, p. 208], the Governor in Council is empowered to make rules for the purpose of preventing or eliminating diseases in the Colony. Government Notice No. 687 of 2nd September, 1937, declares the following to be diseases within the meaning of this Ordinance: Elgon die-back [of coffee], *Hemileia vastatrix* [on coffee], *Nematospora coryli*, *Bacterium tumefaciens*, *Corticium salmonicolor*, sugar-cane mosaic and streak, *Bact. rubrilineans* [on sugar-cane], *Sorosporium reilianum* [on sorghum], *Bact. malvacearum* [on cotton], lily mosaic, *Spongospora subterranea* [on potato], potato mosaic, crinkle, and streak, *Bact. translucens* var. *undulosum* [on wheat: ibid., xvii, p. 384], and groundnut rosette [see above, p. 582].

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FERDINANDSEN (C.) & BUCHWALD (N. F.). **Nogle undersøgelser over tømmersvampe med særligt hensyn til deres fugtighedskrav.** [Some investigations on timber fungi with special reference to their moisture requirements.]—*Dansk Skovforen. Tidsskr.*, xxii, pp. 685–715, 2 diags., 1938.

A detailed, fully tabulated account is given of the writers' studies in Denmark on potato dextrose agar cultures of three wood-destroying fungi, viz., *Coniophora cerebella* [*C. puteana*], *Polyporus vaporarius* [*Poria vaporaria*], and *Merulius lacrymans* [*R.A.M.*, xvii, p. 640], with special reference to their moisture requirements, calculated by the standard wood block method.

Of the three fungi, *C. puteana* was found to require the highest water content in the substratum of spruce (*Picea abies*), the most extensive break-down of which occurred at a water content of 46 to 34 per cent. of the dry weight. *P. vaporaria* ceased growth on blocks with a water content of 32 to 20 per cent. and caused only slight disintegration in one sample at 62 to 46 per cent. *M. lacrymans*, on the other hand, proved to be capable of destroying blocks with a water content as low as 16 per cent. at an atmospheric humidity of 95 to 87 per cent.

The number of spores produced by a single fruit body of the dry rot fungus in a cellar at the Agricultural College, Copenhagen, was calculated to reach a minimum of 1,000,000,000,000.

From fragments of boarding, collected among building refuse in Copenhagen streets, the writers cultured *C. puteana* and *Paxillus acheruntius* [*P. panuoides*].

HUNT (G. M.) & GARRATT (G. A.). **Wood preservation.**—viii+457 pp., 93 figs., 10 graphs, 5 diags., New York & London, McGraw Hill Book Company, Inc., 1938. 30*s*.

In this valuable contribution to the knowledge of wood preservation the writers have attempted to summarize the essential facts contained in the vast mass of literature on the subject and to provide an easily accessible and orderly presentation of the fundamental principles involved in the industry. The book is divided into twelve chapters dealing with: I, the field of wood preservation, II and III, agencies of wood deterioration, IV, wood preservatives, V, preparation of material for treatment, VI, wood-preserving processes, VII, factors affecting penetration and absorption, VIII, economic aspects of preservative

treatment, IX, properties of treated wood, X, treating plant and equipment, XI, methods of protecting wood other than by standard preservative treatment, and XII, fire-retarding treatments. An appendix contains one of the earliest (1716) American wood-preserving patents on record, directions for the determination of preservative penetration and sapwood depth, a sample specification for preservative treatment of timber, and tabulated statistical data relating to material treated in the United States from 1909 to 1936.

COOK (H. T.). **Vegetable seed treatment experiments and practice in Virginia.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1937*, pp. 105–111, 1938.

This paper includes a condensed account of work on cabbage and spinach seed treatment already noticed in this Review from another source [*R.A.M.*, xvii, p. 219].

The author also states that preliminary tests with tomato seed indicated that copper oxychloride, zinc oxide, vasco 4 [ibid., xvii, p. 502], cuprous oxide [ibid., xvii, p. 406], and copper sulphate solution give desirable increases in stand in open seed beds. Increases in stand from the treatments of over 100 per cent. were not infrequent.

On the basis of the author's results and observations a vegetable seed treatment chart has been prepared for seedsmen and farmers. In this, the stronger treatments are recommended, as the author considers these desirable. For example, for tomato seed disinfection, soaking for seven minutes in a 1:2,000 solution of mercuric chloride is recommended, as against the usual recommendation of five minutes' soak in a 1:3,000 solution. Fungicidal dusting after the mercuric chloride treatment is also advised.

In conclusion, the suggestion is made that seedsmen should be required to show on the label the kind of treatment that has been applied to their seeds.

NITSCHE (G.), KOSSWIG (W.), & FÖRSTER (H.). **Histologische und zytologische Veränderungen in kräuselkranken Rüben. (Vorläufige Mitteilung.)** [Histological and cytological changes in crinkle-diseased Beets. (Preliminary note.)]—*NachrBl. dtsch. PflSchDienst*, xviii, 4, pp. 32–34, 8 figs., 1938.

A comparative histological and cytological examination was made of the hypocotyls and root system of healthy and crinkle-diseased beets in Germany [*R.A.M.*, xv, p. 764], the material having previously been fixed in Flemming's chrome osmium acetic acid and stained with safranin, crystal violet, and orange G. The most conspicuous features of the diseased phloem parenchyma were cellular and nuclear hypertrophy with accompanying degeneration, which were detected in the cortex, endodermis, pericycle, and central cylinder. Among the pathological changes in the nuclei were sinuosity and disintegration of the membrane, coagulation and dissolution of the chromatin, vesicular swelling, and final complete degeneration of the nuclear content, of which the nucleole appears to constitute the most resistant element. Coinciding with the nuclear deterioration were plasmatic modifications and disorganization of the cell walls. It is hoped that these alterations

may serve as diagnostic criteria of crinkle, the development of the external symptoms of which, such as bleaching of the leaf veins and foliar distortion, may be delayed for periods of one to six months after the feeding of the insect vector (*Piesma quadratum*) on the plants.

BARATHON-MAZEN (G.). **Emploi du bore contre la maladie du cœur de la Betterave.** [The use of boron against Beetroot heart rot.]—*Vie agr. rur., 1938*, N.S., 4, pp. 158–161, 3 figs., 1938.

In the exceptionally dry summer of 1937 the writer undertook a series of experiments in Allier, France, to determine the effect on heart rot of beets [*R.A.M.*, xvii, p. 285] of a special fertilizer, P.E.C. (Courtois formula), containing 2 per cent. boric acid in addition to the usual ingredients (8–13–19). The percentages of infection and yields in three varieties were as follows: (1) Vauriac; ordinary fertilizer 40 per cent. heart rot, P.E.C. 3 per cent., yields 45,000 and 61,000 kg. per hect., respectively. (2) White semi-sugar Vilmorin; ordinary fertilizer 70 per cent. heart rot, P.E.C. 2 per cent., yields 39,000 and 60,000 kg., respectively. (3) Vilmorin's Red; ordinary fertilizer 80 per cent. heart rot, P.E.C. 2 per cent., yields 36,000 and 70,000 kg., respectively.

LEACH (L. D.) & DAVEY (A. E.). **Determining the sclerotial population of Sclerotium rolfsii by soil analysis and predicting losses of Sugar Beets on the basis of the analyses.**—*J. agric. Res.*, lvi, 8, pp. 619–631, 2 figs., 2 diags., 1938.

After washing soil samples collected from beet fields infected with *Sclerotium rolfsii* [*R.A.M.*, xvi, p. 227] through a series of three screens of 10, 20, and 40 meshes to the inch, respectively, the authors were able to recover sclerotia of the fungus from the residue, and by incubating these at 30° C. on the surface of unsterilized peat soil in Petri dishes, they were able to determine with reasonable accuracy the number of viable sclerotia present in the field soils. It was found that in the sugar beet fields approximately 80 per cent. of the sclerotia occur in the upper 6 in. of soil, and less than 2 per cent. are more than 12 in. deep. For the determination of the populations of sclerotia they took soil samples to a depth of 8 in. in undisturbed soils; the number of viable sclerotia per square foot of soil to the depth of 8 in. was then calculated by methods which are described. Observations were made of the fluctuations in the sclerotial population in permanently marked areas within 17 commercial fields over periods of from two to five years. The results indicated a relatively high correlation between the number of viable sclerotia, determined before planting, and the percentage of infected sugar beets in the same area, and that the number of sclerotia in the soil increased in proportion to the percentage of infection. Sowing infected fields to non-susceptible crops such as wheat or barley, or to winter crops such as peas, resulted in a rapid reduction of the sclerotial population. Susceptible crops, such as beans, when abundantly irrigated during the summer months, usually maintained the sclerotial populations at a moderately high level. Soil analyses from fields subsequently sown to sugar beets showed that fields with over 200 viable sclerotia per sq. ft. invariably showed over 15 per cent. loss of sugar beets, while those with less than 100 sclerotia per sq. ft. usually

showed less than 10 per cent. loss. It is considered that this method may be useful in allowing severely infected soils to be avoided before sowing sugar beets.

Crosier (W.) & Patrick (S.). **The value of chemical seed treatments in germination studies.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1937*, pp. 117–121, 1938.

The authors point out that as the larger agricultural seeds generally used in chemical treatment tests are carriers of various micro-organisms which develop on dead or decadent seeds, it is necessary for a chemical to protect the seedlings as well as eliminate the micro-organisms. This was illustrated by a test in which duplicated rolls of 100 untreated pea seeds each gave 54, 70, 72, 67, and 72 per cent. germination, respectively. In every roll moulds were abundantly present and had penetrated to the adjacent rolls of treated seed. Seeds from the same samples treated by an instant dip in ethyl mercuric chloride were placed in contact with the untreated rolls, and the resulting percentages of germination were, respectively, 84, 92, 95, 85, and 78, i.e., increases of 6 to 30 (average 19·8) per cent.

The data obtained from tests with untreated pea seed and seed treated with new improved ceresan and mercuric chloride, applied as dips at a concentration of 0·15 per cent., the seeds being germinated in paper rolls at 20° C., showed that (1) the apparent number of normal sprouts in severely contaminated samples was increased by the treatments, (2) the germination of almost clean, strong seed is little affected by chemicals, (3) the treatments virtually eliminated fungal growths, (4) the treatments restricted bacteria to the point of origin of infection, but did not prevent bacterial soft rot of dead or decadent seeds, and (5) the treatments increased the total weight of the seedlings.

Experiments on pea seeds with a mixture made up of 20 parts copper stearate, 4 parts inert dust, and 1 part new improved ceresan gave very successful results in increasing apparent germination. Cuprous oxide, copper sulphate, and zinc oxide also eliminated the associated fungi. Onion seed treated with new improved ceresan dust germinated rather better than that treated with cuprous oxide dust but both methods gave more satisfactory results than treatment with the new improved ceresan dip. Cabbage, morning glory [*Ipomoea* sp.], sweet pea, salsify, cucumber, and muskmelon seeds were all benefited by dust and dip treatments, the mercury compounds increasing germination slightly more than the copper compounds, though both were very satisfactory.

Crosier (W.). **The pathogenicity of Fusarium spp. in commercial Pea seed.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1937*, pp. 112–116, 1938.

In 1932, only 0·6 per cent. of the pea seed stock examined by the Association of Official Seed Analysts of North America was infected with species of *Fusarium* [cf. *R.A.M.*, xvi, p. 512; xvii, p. 431], the figures for the years from 1933 to 1937 being, respectively, nearly 7, about 2·2, 2·9, 1·1, and 1·4 per cent. Many of the infected seeds were surface-sterilized and placed on sterile agar, but *Fusarium* was isolated on every occasion, proving that these fungi establish themselves internally. Germination tests demonstrated the pathogenicity of these

organisms, the most injurious strains being found on stocks from the western United States. Peas, on the other hand, harvested in New York and Ontario contained 10 to 15 per cent. dead seeds infected with *Fusarium* spp., and *Rhizopus nigricans*, of which none of the former were pathogenic. These observations indicated that pathogenic species of *Fusarium* are seed-transmissible and common only to regions where wilt (*F. orthoceras* [var.] *pisi*) [ibid., xv, p. 339] is prevalent, though the symptoms caused by them are those of rotting, not wilt, whence it may perhaps be inferred that the wilt organism plays no part in the disease.

In experiments in 1937 on five varieties of peas grown in pots on sterilized soil and inoculated with cultures on wheat grains of *Fusarium* spp., *Alternaria* sp., bacteria, *Rhizoctonia* [*Corticium*] *solani*, and *Ascochyta pinodella* [ibid., xvii, p. 427] isolated from pea seeds, it was found that while a few of the strains were almost as injurious to pea seedlings as *C. solani*, some caused no significant decreases in stand; the average green weights of all the seedlings in the pots contaminated with *Fusarium* was 4·15 gm., as against 4·89 for the control seedlings. When a second lot of peas was sown in the same pots immediately after the conclusion of this test, it became obvious that only six of the *Fusarium* cultures depressed emergence. It appears certain that the *Fusarium* species common to pea seeds are not aggressive pathogens, that they do not cause wilt, and that they induce root rot or seed decay only when the mycelium is highly concentrated and free from other organisms.

Davis (G. N.). **Germination of treated and untreated Pea seeds in autoclaved and unautoclaved soil.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1937*, pp. 121–125, 1938.

In these experiments two lots of Alaska pea seed, one containing a high percentage of diseased seed and the other being almost free from disease, were germinated in autoclaved and unsterilized greenhouse compost at 20°, 15°, and 10° C., the seed being treated with either mercuric chloride 1 in 500, cuprocide [*R.A.M.*, xvi, p. 625; xvii, pp. 219, 540], copper oxychloride, formafume, ceresan, or 1 per cent. ethyl mercury phosphate, or left untreated as a control. The results obtained [which are tabulated] showed that the autoclaved compost consistently gave higher percentage germinations than the unsterilized, this applying both to the treated and untreated seed. All the seed treatments were beneficial in giving maximum germination of both lots of seed, especially in the unsterilized compost and at the lower temperatures. The best germination results were given by the ethyl mercury phosphate, ceresan, and cuprocide. The disease-free lot of seed in all cases consistently gave higher percentage germinations than the diseased lot, showing that it is very desirable for growers to use high quality seed.

Gigante (R.). **Il mosaico della Fava ('Vicia faba' L.) in Italia e comportamento di alcune Leguminose di fronte ad esso.** [Broad bean (*Vicia faba* L.) mosaic in Italy, and the reaction of some Leguminosae to it.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 4, pp. 497–529, 1 pl., 17 figs., 1937. [Received May, 1938.]

During 1937, broad beans (*Vicia faba*) growing in the vicinity of Rome were widely affected by mosaic [*R.A.M.*, xv, p. 28; xvii, p. 575],

the symptoms of which appeared to be identical with those described by Böning [ibid., vii, p. 134], and took both the form of marbling and of veinal mosaic, accompanied, especially in the case of the former, by curling and rolling. The affected plants were stunted, and gradually withered.

Artificial inoculations of healthy broad beans by rubbing the leaves with infected material and by the transference of juice from affected plants gave positive results in 16 per cent. of the tests. Inoculations of healthy peas with juice from affected broad beans gave 14 per cent. positive results [cf. ibid., xvii, p. 575], the symptoms set up being similar to those produced by pea virus 2 C [ibid., xvi, p. 583]. Inoculations of *Phaseolus vulgaris* leaves gave 100 per cent. positive results, the symptom patterns set up differing widely with the variety. The disease was also successfully transmitted to *Trifolium repens* and *Astragalus* sp. The author concludes that the disease is due to a virus complex.

El-Helaly (A. F.). **A chocolate spot disease of Beans (Vicia faba). Part I.**—*Bull. Minist. Agric. Egypt* 191, 8 pp., 2 pl., 1 fig., 2 graphs, 1938.

Beans (*Vicia faba*) in the northern parts of Lower Egypt are very severely affected by chocolate spot, caused by *Botrytis fabae* [*R.A.M.*, xvi, p. 724; xvii, p. 15]. High atmospheric humidity favours the recurrence of the disease, the regional intensity of which increases with increasing rainfall. Laboratory studies showed that the fungus made best growth near P_H 4·5, the optimum temperature being about 20° C. The optimum temperature for germination of the conidia was about 21° and the thermal death point 51° (30 seconds' exposure), the corresponding figures for the formation and death of the sclerotia being near 20° and 51°. The conidia measure 14·5 to 29·1 by 11·3 to 19·4 (average 22·5 by 14·7) μ, and the sclerotia 0·6 to 3·8 by 0·4 to 3 by 0·8 (average 1·7 by 1·3 by 0·8) mm. [cf. ibid., ix, p. 424; xiv, p. 734]. The Egyptian, Spanish, and Cyprus strains of the fungus appear to be similar in all respects, except that the sclerotial measurements of the first differ slightly from the others.

Murphy (D. M.) & Pierce (W. H.). **A mosaic-resistant small red Bean.**—*Phytopathology*, xxviii, 4, pp. 270–273, 1938.

Excellent results in respect of resistance to common mosaic (bean virus 1) and curly top [*R.A.M.*, xvii, p. 90] have been obtained in Idaho with two selections, U.I. 3 and U.I. 34, of the Red Mexican bean [*Phaseolus vulgaris*] variety, both of which outyielded their parent in field tests in 1936 and 1937 (average yields per acre of U.I. 3, U.I. 34, and Red Mexican being 32·6, 33·3, and 23·9 lb., respectively), besides showing complete immunity from both diseases. Arrangements have been made for the release of stocks of the new beans to local growers.

Newhall (A. G.). **The spread of Onion mildew by wind-borne conidia of Peronospora destructor.**—*Phytopathology*, xxviii, 4, pp. 257–269, 4 figs., 1938.

In the summer of 1937, when abnormally wet conditions prevailed

in New York State, onion mildew (*Peronospora destructor*) [*P. schleideniana*: *R.A.M.*, xvii, p. 588] conidia were caught in the air over diseased fields to a height of 1,500 ft. Of 132 trapped on one 40-minute flight, 100 (75 per cent.) germinated. The conidia were experimentally shown to survive freezing in a block of ice (12 per cent. germination), seven hours' exposure to bright sunshine in drops of water (6·9 per cent. germination), and at least five days in the dark at a temperature of 9° C. and an atmospheric humidity of 70 per cent. A high proportion of the perennial topset and multiplier onions commonly found growing in farm gardens and in the small towns of agricultural counties showed mildew infection in June, and mycelium was detected in the bulbs in November. In some seasons, at any rate, these diseased perennial onions constitute a decided menace to the $2,000,000 commercial onion crop of the State, *P. schleideniana* having been shown by aerial dissemination tests to be wind-borne. Malachite green in dilutions up to 1 in 150,000 was found to be twice as toxic to the fungus as copper sulphate [ibid., xvii, p. 154].

Richardson (J. K.). **Studies on blackheart, soft rot, and tarnished plant bug injury of Celery.**—*Canad. J. Res.*, Sect. C, xvi, 4, pp. 182–193, 3 pl., 3 diags., 1938.

The author investigated the interrelationship of the various factors involved in the causation of black heart of celery [*R.A.M.*, xi, p. 279; xv, p. 777], primarily a physiological disorder attributed to unsuitable environmental conditions, and complicated by secondary infection by *Erwinia carotovora* and insect injury. The disease is stated to be very prevalent and destructive in certain market-gardening districts in Ontario. It occurs most extensively at the beginning of maturity, producing discoloration and water-soaking of the youngest heart leaves, followed by necrosis of the tips, margins, veins, or entire blades of the older leaves. Field observations, confirmed by greenhouse experiments, showed that the disease appeared during or after periods of high temperature or high humidity or both. The disease was most severe in vigorous plants and in early plantings. None of the celery varieties tested showed complete immunity from the disease, although Golden Plume and Golden Phenomenal showed considerable resistance. *E. carotovora*, associated with soft rot of celery, is stated to be a secondary invader of plant tissue affected with black heart, causing a soft, watery, light brown decay, which under moist conditions leads to rapid destruction of the plant. The tarnished plant bug (*Lygus pratensis*) causes considerable damage by spreading soft rot and destroying the fleshy stalks, leaf petioles, or in many cases the vascular tissue by toxic action during feeding, but has no relation to the primary black heart condition.

Price (W. C.) & Wyckoff (R. W. G.). **The ultracentrifugation of the proteins of Cucumber viruses 3 and 4.**—*Nature, Lond.*, cxli, 3572, pp. 685–686, 1 fig., 1938.

Purified solutions of Ainsworth's cucumber mosaic viruses 3 and 4 [*R.A.M.*, xiv, p. 554] were obtained after two quantity ultra-centrifugations, using saline for re-solution of precipitated protein and a period of centrifugation sufficient to sediment only a negligible amount

of the lighter component present in the juice of both healthy and diseased plants. Under the conditions obtaining in these experiments, the two heavy components were almost completely separated by applying a centrifugal field of 40,000 times gravity for not more than half an hour. The proteins of cucumber viruses 3 and 4 differ from unaltered tobacco mosaic virus protein in their virtual insolubility in pure water. Saline, however, dissolves them and facilitates the break-down of traces of the smaller high molecular weight substances.

The heavier components of the cucumber viruses are highly infectious and are no doubt essentially the same as the proteins of Bawden and Pirie [ibid., xvi, p. 346; xvii, pp. 564, 619]. As nearly as can be determined, the tobacco mosaic protein and those of the cucumber viruses sediment at the same rate and thus probably have the same molecular weights; their sedimentation constants are $s_{20} = 173 \times 10^{-13}$ cm. sec.$^{-1}$ dynes^{-1} and $s_{20} = 175 \times 10^{-13}$ for the cucumber viruses 3 and 4, respectively, compared with $s_{20} = 174 \times 10^{-13}$ for tobacco mosaic [ibid., xvii, p. 207]. The more rapidly sedimenting components ($s_{20} = 200 \times 10^{-13}$) detected in tobacco mosaic virus protein derived from plants infected for over four weeks were also found in the cucumber viruses.

Particular interest attaches to the presence in cucumber plants of a homogeneous high molecular weight substance distinct from the virus protein. Purified solutions from either healthy or diseased plants sediment with a single fairly sharp boundary corresponding to $s_{20} = 77 \times 10^{-13}$. They have given the usual qualitative tests for proteins and have constantly maintained a clear chlorophyll-green colour. Water solutions may be kept for several days in the ice-box, whereas in saline decomposition is more rapid. The repeated ultracentrifugation of saline solutions of purified cucumber mosaic and tobacco mosaic virus proteins denatured these substances and rendered them insoluble.

CAYLEY (DOROTHY M.). **Experimental spawn and Mushroom culture. II. Artificial composts.**—*Ann. appl. Biol.*, xxv, 2, pp. 322–340, 2 pl., 1938.

The author describes continued studies on artificial composts for the growth of mushrooms (*Psalliota campestris*, *P. arvensis*, and the wild haystack mushroom, an undetermined species of *Psalliota*) [*R.A.M.*, xvi, p. 725]. Artificial compost I, composed of two trusses of wheat straw, two trusses of hay (2 years old), one large sack of chopped straw, one large sack of chopped hay, 1 lb. sulphate of ammonia, 4 lb. slaked lime, and ½ lb. phosphate of potash, stacked in thin layers, damped, and left until the temperature rose to 110° to 120° F., then turned over four times and the bed cased with soil and lime after 3 to 4 weeks, gave better results in the open, where it produced a fair crop of several flushes 5 to 6 months after spawning. Artificial compost II, consisting of two sacks chopped straw, two sacks chopped hay, 6 oz. sulphate of ammonia, 2 lb. slaked lime, and ½ lb. phosphate of potash, turned over four times during 9 days, the temperature reaching 165°, and then made into beds, gave very unsatisfactory results except with one of the cultivated varieties, which produced a good clump of normal pilei 4 months after spawning. The wild grassland species (*P. campestris* and *P. arvensis*) failed to grow in any low temperature (90°) composts,

composed of the same ingredients as compost II; the wild haystack mushroom grew and fructified on a compost subjected to fermentation for one month but not longer, and the cultivated varieties grew well on composts subjected to fermentation for 1 to 2 months. In experiments with fermented composts, and with composts allowed to rot naturally without heat in the open, no growth occurred in composts made of 1 large sack chopped hay, 1 large sack of dried lawn mowings, 10 oz. sulphate of ammonia, some without lime and some with 4 oz. slaked lime, and an equal volume of soil when fermented to 160°, while the same mixture naturally rotted without heat produced normal pilei. The addition of garden soil reduced the alkalinity of both fermented and naturally rotted composts in most cases, with the exception of some fermented composts, where alkalinity was increased; it also reduced the temperature and induced early formation of strands. The experimental results indicate that the various composts, both fermented and naturally rotted, with and without lime, contain the necessary nutrients for the growth of the cultivated mushroom, provided that adequate aeration and friability are secured. Artificial heating would probably be necessary to obtain results comparable with those from horse manure.

Mendoza (J. M.). **Philippine Mushrooms.**—*Philipp. J. Sci.*, lxv, 1–2, pp. 1–128, 79 pl. (13 col.), 5 figs., 1938.

In view of the increasing popularity of mushrooms as an article of diet in the Philippines and the widespread need for enlightenment concerning their properties, the author has prepared a copiously annotated list of the edible, poisonous, and other species of the numerous genera, including *Amanita, Lepiota, Collybia, Pleurotus, Clitocybe, Lentinus, Volvaria* (with *V. esculenta*) [*R.A.M.*, xvi, p. 660], *Psalliota*, and *Peziza*, in which the Islands abound. The taxonomic section of the paper is preceded by some introductory observations, a glossary, directions for the differentiation of mushrooms and toadstools, remarks on various physiological and morphological aspects of mushroom development, native names of mushrooms and superstitions concerning their relation to weather conditions, a summary of the available knowledge of mushroom toxicology, and notes on the importation of mushrooms into the Philippines, local methods of cultivation, and the possibilities of profitable commercial production, especially of *V. esculenta* and *Psalliota campestris*, the latter growing well under controlled temperature conditions on rice straw instead of manure [cf. preceding abstract].

Storey (H. H.) & Nichols (R. F. W.). **A field experiment in the transmission of Cassava mosaic.**—*E. Afr. agric. J.*, iii, 6, pp. 446–449, 13 graphs, 1938.

In field experiments started in March, 1934, the authors investigated seasonal differences in the spread of the mosaic disease of cassava [*R.A.M.*, xvii, p. 371] and the susceptibility of plants in relation to their age. The experimental plots were situated at Kiwanda near Amani, where the mean monthly records over seven years show a fairly even rainfall throughout the year, rising to a peak in May and falling to

minima in January and July. At the beginning of each month during two years one healthy cassava plant of the Ubarika variety was planted in each of 48 9-plant square plots, which were surrounded by a hedge of mosaic-diseased cassava so that all experimental plants were exposed to a high and nearly equal rate of infection. All plants that had become infected were removed at the beginning of each month, and after 8 months from planting all surviving healthy plants, being now mature, were also removed, so that, had no infection occurred, each plot would have contained at any time after 8 months 8 plants from 1 to 8 months old. The results of both years were in close agreement and showed that plantings made in June survived, largely uninfected, for the longest time; May, July, and August were to a lesser degree also favourable planting months, while all plantings from December to April showed a high incidence of disease after three months' growth. After eight months' growth, however, almost all plantings were entirely diseased, the only survivals dating from May and June. The infections recorded during the second month of growth were significantly less than during any other month, owing, it is suggested, to their being the result of inoculations received between the middle of the first and the middle of the second month, when the cuttings had barely started to produce shoots and had not, therefore, been exposed to infection for the full period of a month. In plants over two months old the figures showed no significant relation between the age of the plant and its susceptibility. The probability of infection for plants in all age classes over two months varied largely with the season, being high from February to May (highest in March), falling rapidly after May, and remaining low from August to October. The advantage of June planting is thus again apparent, as the plants then pass the main period of their growth during months with the lowest probability of infection.

Pacca (D. W.). **Contribuição ao estudo das doenças da Mandioca.** [Contribution to the study of Cassava diseases.]—*Rodriguésia*, iii, 10, pp. 171–178, 8 figs., 1937. [Received June, 1938.]

The author states that, judging from the copious material sent in for examination from several States of Brazil from 1934 to 1936, the chief disease of cassava in the Republic is bacteriosis of the underground stems and roots, the main symptoms of which are internal discolorations and pronounced stunting, and in advanced cases rotting due to infection with secondary organisms such as *Diplodia* sp. and *Bacillus amylobacter*. Isolations from the margins of young infections yielded rods generally agreeing with *B. manihotus* Arthaud & Berthet, but differing from it in some cultural characters. So far artificial inoculations with the organism have not yielded positive results owing to some technical difficulties, but further work is in hand to determine its pathogenicity. During the spring of 1937 a small outbreak of rust was noticed in the experimental field of the Institute of Plant Biology, Rio de Janeiro, on several cassava varieties, the causal fungus of which agreed in the structure, colour, and size of its teleutospores with *Uromyces manihotis* Henn.; the author also found globose or elliptical, finely echinulate uredospores, 22 to 25 μ in diameter, with a pale yellowish epispore, 3 μ in thickness, and a thick, hyaline, occasionally

persistent pedicel; these spores are not described in Hennings's diagnosis. The rust attacked simultaneously the branches, buds, fruits, petioles, and new leaves of cassava plants, resulting in the development on these organs of more or less extensive hypertrophied or necrotic areas, and the production of witches' brooms. As a safeguard it is recommended that all diseased plants should be destroyed as soon as noticed. Some varieties in the field gave clear indications of being immune from the disease. A brief account is given of two leaf spots of minor importance, the first of which, however, caused by *Helminthosporium manihotis* Rangel, may be troublesome in thick cassava stands during warm, rainy seasons, and is fairly frequent in the Federal District; the other, due to *Cercospora caribaea* [*R.A.M.*, xv, p. 59] is only sporadic on certain varieties.

JENKINS (W. A.). **Two fungi causing leaf spot of Peanut.**—*J. agric. Res.*, lvi, 5, pp. 317–332, 1 pl., 5 figs., 1938.

A detailed account is given of the author's studies since 1934 of *Cercospora arachidicola* and *C. personata* [*R.A.M.*, xiii, p. 74], which are stated to cause serious defoliation of the varieties (especially the Spanish) of groundnut commonly grown in Georgia. In addition to conidia and spermogonia both fungi were found to produce perithecia, the genetic connexion of which with the conidial stages was established from the study of sectioned material and also by the fact that the symptoms obtained from the inoculation of healthy groundnut plants with ascospores were indistinguishable from those occurring in nature or resulting from inoculation with conidia. In neither species, however, were perithecia formed in pure cultures. On the basis of their morphological characters the two organisms are referred to the genus *Mycosphaerella* as *M. arachidicola* n.sp. and *M. berkeleyii* n.sp., respectively [with Latin diagnoses]. The first is characterized by scattered amphigenous, erumpent, ovate to nearly globose, black perithecia with a slightly papillate ostiole, 47·6 to 84 by 44·4 to 74 μ in diameter (and occurring mostly along the margins of the lesions); the asci are cylindrical-club-shaped, short stipitate, fasciculate, eight-spored, and 27 to 37·8 by 7 to 8·4 μ. The ascospores are uniseriate to imperfectly biseriate, two-celled, slightly curved, hyaline, and 7 to 15·4 by 3 to 4 μ (average 11·2 by 3·6 μ). The same description also applies to the ascogenous stage of the second, except for the size of the perithecia (84 to 140 by 70 to 112 μ), of the asci (30 to 40 by 4 to 6 μ), and of the ascospores (10·9 to 19·6 by 2·9 to 3·8 μ, average 14·9 by 3·4 μ).

In both species the formation of the perithecia is initiated in the autumn, simultaneously with that of the spermogonia, and additional evidence was obtained indicating that spermatia function as male sexual elements in the production of perithecia.

WOLLENWEBER (H. W.). **Fusariosen des Katjangs, Cajanus indicus.** [Fusarioses of Pigeon Pea, *Cajanus indicus*.]—*Arb. biol. Anst. (Reichsanst.), Berl.*, xxii, 3, pp. 339–347, 2 figs., 1938.

An expanded Latin diagnosis is given of *Fusarium lateritium* Nees var. *uncinatum* Wr. 1930 (syn. *F. uncinatum* Wr. 1917), held in pure culture since its original isolation from pigeon pea (*Cajanus indicus*)

[*C. cajan*] in India by E. J. Butler in 1905 and successfully inoculated into seedlings of the same host (70 per cent. infection) and reisolated from the diseased tissues in recent experiments at the Biological Institute, Berlin-Dahlem. The best results were obtained by the admixture with the pot soil of a minute quantity of ground mycelium from a barley groats culture. The affected plants developed a brown rot of the rootstock and stem base. This form of pigeon pea fusariosis and the wilt caused by *F. udum* [*R.A.M.*, x, p. 775] Butl. non Berk. differ from those associated with the plurivorous *F. anguioides*, *F. solani* and its var. *striatum*, *F. vasinfectum* [ibid., xvi, p. 151], and *Neocosmospora vasinfecta* [ibid., xiv, p. 144] in being restricted, so far as is definitely established, to the one host. The pigeon pea crop in India is therefore subject to two forms of fusariosis, of which the wilt due to *F. udum* appears to be of greater importance than the foot rot caused by *F. lateritium* v. *uncinatum*. A similar dual form of *Fusarium* infection is manifested by a number of other economic plants.

ZILLIG (H.). **Die Praxis der Peronospora und Oidiumbekämpfung.** [*Peronospora* and *Oidium* control in practice.]—*Wein u. Rebe*, xx, 4, pp. 120–126, 1938.

Under the conditions normally prevailing at the Bernkastel-Kues (Moselle) branch of the German Biological Institute, three applications of $\frac{3}{4}$ to $1\frac{1}{2}$ per cent. Bordeaux mixture are sufficient for the control of *Peronospora* [*Plasmopara viticola*] on the widely grown Riesling vine variety—the first to coincide with the initial outbreak of infection as forecast by means of Müller's incubation calendar [*R.A.M.*, xvii, p. 292], the second (and most important) after flowering, when 90 per cent. of the corollas have fallen and the fruits are beginning to set, and third during the last ten days of July or early in August. In the case of the susceptible Gutedel and Müller-Thurgau varieties a preliminary treatment before the first expected outbreak of infection is advisable. In nurseries it is necessary to take special precautions, anticipating the development of the fungus by spraying the leaves immediately on unfolding with $\frac{3}{4}$ per cent. copper oxychloride and repeating the treatment at 10-day intervals, which must subsequently be reduced to 8 and in July and August to 5 days. The burying of debris before the renewal of spring growth is of the utmost importance both in the nursery and vineyard.

Two applications of sulphur dust, one during the latter half of May and a second immediately after flowering, are adequate in normal years for the control of *Oidium* [*Uncinula necator*: see next abstract].

PEGLION (V.). **La lotta contro l'oidio della Vite.** [The campaign against the Vine *Oidium*.]—*Ital. agric.*, lxxv, 1, pp. 3–6, 1938.

In connexion with a general account of the life-history of *Oidium* of the vine [*Uncinula necator*] and the ecological conditions favouring its development, the writer mentions that in Italy the Trebbiani, Sangioveto, Luglienga, and Moscati varieties are particularly susceptible. Three applications of sulphur should be given: the first when the shoots have attained a length of 10 to 12 cm., the second at flowering, and the third when the grapes are turning black.

Marsais (P.) & Ségal (L.). **Contribution à l'étude de l'action anticryptogamique du cuivre.** [A contribution to the study of the fungicidal action of copper.]—*Rev. Vitic., Paris,* lxxxviii, 2286, pp. 285–287; 2287, pp. 305–311; 2288, pp. 325–327, 1938.

After an introductory section briefly indicating the factors that affect the control of vine mildew (*Plasmopara viticola*) by Bordeaux mixture, such as environmental and weather conditions, susceptibility of the host to infection, age of the leaf, and life-cycle of the fungus, the authors summarize and briefly discuss current views on the manner of action of the fungicide. In particular they discuss the amount of copper required for the toxic dose, whether the spore must be killed or germination merely prevented, chemical changes undergone by the mixture during the period of its retention on the leaf, and whether the toxic effect on the fungus is due to the cupric deposit being rendered soluble, to the penetration of the plant by the copper deposit, or to electrical phenomena. On the basis of this survey suggestions are made for a programme of research.

Emon (J.). **Court-noué et Phylloxéra.** [Court-noué and *Phylloxera.*]—*Rev. Vitic., Paris,* lxxxviii, 2287, pp. 303–305, 1938.

Observations made by the author during recent travels in the south of France and northern Italy showed that court-noué of the vine [*R.A.M.*, xvi, p. 366; xvii, pp. 222, 372] has become alarmingly prevalent in these localities, especially during the last two years. The disease causes most damage in young vineyards, where it is often overlooked until it is too late for remedial measures to be of use. In the author's opinion, *Phylloxera* [*vastatrix* f. *radicicola*] aggravates the disease by destroying the rootlets, and so increasing the rapidity of the invasion by court-noué [but cf. ibid., xvii, p. 222]. The 333 vine is attacked by court-noué in severe outbreaks, but Aestivalis and Monticola have so far shown resistance, though very susceptible to *Phylloxera*. The disease has appeared in soil not planted to vines for 15 years, and in other soil not previously planted to vines at all. Excessively deep trenching probably assists spread, and temperature may play some part. The remedy appears to lie in the selection of resistant stocks.

Laurent (P.). **Le pourridié de la Vigne.** [Root rot of the Vine.]—*Rev. Vitic., Paris,* lxxxviii, 2279, pp. 159–165, 6 figs., 1938.

The author states that two fungi, *Rosellinia necatrix* and much less commonly *Armillaria mellea*, are chiefly responsible for root rot of the vine in France, and gives a comparative description of the symptoms caused by them. While in heavy, wet soils root rot usually results in the relatively rapid death of the stock, on lighter and dry soils the lethal issue of the attack may be delayed for several years, the only macroscopic symptom being a yellow or brown discoloration of the woody tissues throughout the plant; in such cases the collapse of the diseased stocks may be sudden, and may be confused with apoplexy. All stocks affected by these fungi should be carefully removed with all their roots from the vineyards, and the soil under them disinfected with either carbon disulphide or formalin. Where newly broken land is suspected to be infected with either or both of the fungi, it should be disinfected previous to planting to vines, or be sown for several years with a crop

resistant to the pathogens. Infection may be introduced with rooted vine cuttings from infected nurseries.

MARCHAL (E.). **Observations et recherches effectuées à la Station de Phytopathologie de l'État pendant l'année 1937.** [Observations and researches carried out at the State Phytopathological Station during the year 1937.]—*Bull. Inst. agron. Gembloux*, vii, 2, pp. 134–142, 1938. [Flemish, German, and English summaries.]

This report [cf. *R.A.M.*, xvi, p. 728] contains, among others, the following items of phytopathological interest. The Jubilé wheat variety (developed at Gembloux) continues to show resistance to *Ustilago nuda tritici* [*U. tritici*]. Straib's hereditary foliar necrosis [ibid., xv, p. 352] appeared regularly on certain varieties of wheat.

Marssonina graminicola [*Rhynchosporium secalis*: ibid., xvii, p. 22] was observed early in April seriously affecting winter barley, even the upper leaves of which showed characteristic spotting.

Potatoes, particularly of the Industrie variety, showed foliar necrosis due to Bawden's D virus [ibid., xvi, p. 704], the symptoms consisting of brownish or necrosed, localized, interveinal spots.

Flax showed an exceptional degree of infection by *Olpidiaster* [*Asterocystis*] *radicis* [ibid., xiv, p. 362], but was not seriously affected by any other disease.

Other records include *Heterosporium allii* on leeks [ibid., xi, p. 423; xvi, p. 773]; *Septoria phlogis* on phlox [ibid., xvii, p. 113] (a new record for Belgium); *S. chrysanthemella* on chrysanthemums [ibid., xvii, p. 181]; *Corticium vagum* [*C. solani*] causing a slow wilt, beginning as a discoloration and browning of the leaves, of *Araucaria*, which assumed epidemic proportions in some cases; *Thielavia basicola* forming superficial black crusts (with no apparent after-effect) on *Gloxinia*; severe and widespread infection of cherries by *Ascospora beyerinckii* [*Clasterosporium carpophilum*: ibid., xvi, p. 388]; *Gnomonia leptostyla* on walnut [ibid., xvi, p. 840] (more prevalent than usual); and the following on Canadian poplar [*Populus canadensis*]: canker (*Nectria galligena*) [cf. ibid., xiv, p. 478], *Didymosphaeria populina* [ibid., xi, p. 137], *Dothichiza populea* [ibid., xvii, p. 569], and a tracheomycosis caused by a species of *Cytospora*.

NEERGAARD (P.) **Aarsberetning fra J. E. Ohlsens Enkes plante-patologiske Laboratorium 1 April 1937–31 Marts 1938.** [Annual report of the phytopathological laboratory of J. E. Ohlsen's widow from 1st April, 1937 to 31 March, 1938.]—12 pp., 1 fig., 1938. [English and Esperanto summaries.]

During the period under review the following fungi were detected among the 2,760 samples of horticultural seed inspected at the abovementioned Copenhagen seed-grower's phytopathological laboratory [cf. *R.A.M.*, xvii, p. 96]. *Alternaria porri* (Ell.) n. comb. (= *Macrosporium porri*) was found contaminating Zittau yellow onion seeds [ibid., xi, p. 224] and was inoculated through the soil into Silver-White Dutch leek seedlings with positive results. Hazel nuts (*Corylus avellana*) were infected by *Macrophoma corylina*. Both these records are new for Denmark, while the following hosts were attacked for the first time

by fungi already recorded: *Papaver alpinum*, *P. nudicaule*, and *P. umbrosum* seeds by *Helminthosporium papaveris* [ibid., xvii, p. 96], the two first-named, *P. glaucum*, *P. orientale*, and *P. paeoniflorum* by *Phoma rhoeadis*, and *Nemophila insignis* and *N. atomaria* by *P. nemophilae* [see below, p. 703], which causes typical damping-off of the seedlings and a virulent wet rot of the stems and leaves of older plants under warm, humid conditions.

SĂVULESCU (T.), ARONESCU (A.), SANDU-VILLE (C.), & ALEXANDRI (A. V.). **Starea fitosanitaria în România în anul 1935–1936.** [Phytosanitary conditions in Rumania during the year 1935–6.]—*Publ. Inst. Cerc. agron. României* 38, 70 pp., 6 figs., 1937. [Rumanian, with French translation. Received May, 1938.]

Following a summarized account of the relative incidence and severity of wheat rusts (*Puccinia triticina*, *P. graminis*, and *P. glumarum*) in the different wheat-growing centres of Rumania in 1935–6, a classification is given of the wheats tested during that year at two experimental Stations in the order of their resistance to all the three rusts together; at one Station three pure lines (American 15, Dalga 2 and 3) were found to be immune, and at the second 19 lines were classified as resistant. Wheat bunt (*Tilletia tritici* [*T. caries*] and *T. foetens*) was widespread throughout the country, and in some peasant holdings caused from 50 to 60 per cent. reduction in yield. The attacks were severe even in fields sown with seed-grain treated with disinfectant dusts, partly because of the dryness of the soil at autumn sowing, and partly owing to the inefficacy of certain preparations.

A virus disease of soy-beans is recorded characterized by curling of the leaves, and by brown or yellow mosaic, the last-named form being the most widespread. In varietal tests at two experimental Stations, for resistance to yellow mosaic, the variety Ossyeck was placed in class I at one Station and in II at the other.

Pseudomonas [*Bacterium*] *malvacearum* [*R.A.M.*, xvii, pp. 392, 439, 521] was again recorded on cotton in the country. Experiments at the Rumanian Institute for Agricultural Research indicated that cotton varieties with pubescent stems and leaves are in general more susceptible to the disease than the glabrous; the most resistant variety was Batonta, originating in Greece, the only drawback of which is that it is too late maturing for Rumanian conditions. It was also observed that cotton, grown in units of two rows alternating with two rows of maize in the field, was less attacked by *Bact. malvacearum* than in the absence of maize.

A brief historical outline is given of the appearance and development in Europe of *Puccinia antirrhini* on snapdragon [*Antirrhinum majus*], which was first recorded in Rumania in 1936 [ibid., xvi, p. 776] and appears to have gained ground in the country. Apart from the immediate destruction of all rust-diseased snapdragon plants, it is recommended that the plants be dusted with sulphur at the earliest appearance of the pustules.

Entyloma dahliae [ibid., xvi, p. 464] was first recorded on dahlias in Rumania in 1936 and is believed to have been introduced with earth-covered roots from abroad some four years before. Observations in the gardens of the Royal Castle at Bran indicated that the leaf spot caused

by the fungus is most severe in damp and shady spots; potash fertilizers increased the resistance of dahlias to the disease, but not superphosphate or calcium cyanamide; soil deficiency in lime predisposed even resistant varieties to the disease. When working over the soil of diseased dahlia beds, care should be taken not to dig in the fallen leaves, since the chlamydospores carried by them may remain viable for several years, and may start fresh infections when the soil is again worked over with a spade, bringing the remnants of the old leaves to the surface. Further observations showed that in general, Rumanian varieties and *Dahlia nana* varieties are the most resistant to the disease; of 62 varieties tested 17 were shown to be resistant, 8 slightly susceptible, and 37 susceptible.

Fireblight of apples (attributed to *Bacillus amylovorus*) [*Erwinia amylovora*] is reported from Bukovina [unsupported by bacteriological evidence], and exanthema was observed on hothouse lemons [ibid., xvi, p. 451].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 5, pp. 256–260, 5 figs., 1938.

In these notes it is stated that control of *Gibberella saubinetii* on maize depends essentially on the prompt destruction of the old stalks by burning (after cutting them out with a hoe and raking them together) and the adoption of crop rotation, but the selection of seeds free from infection is advocated as a precautionary measure. In the control of bean [*Phaseolus vulgaris*] anthracnose, *Colletotrichum lindemuthianum* [ibid., xvii, pp. 369, 574], the planting of resistant varieties is advocated, above all the Tweed Wonder variety, which was originally selected from a crop of Canadian Wonder beans and is resistant to all strains of the fungus present in New South Wales. The following measures of control are recommended against beet leaf spot, caused by *Cercospora beticola* [ibid., xvii, pp. 428, 440]: the use of clean seed, or disinfection of the seed with an organic mercury compound or with formaldehyde solution (15 in 1,000 for 7 minutes); planting in clean soil (seed-beds may be sterilized with formaldehyde before sowing); wide spacing of the plants; spraying with Bordeaux mixture (1–1–12) at 10- to 14-day intervals; and plant sanitation and crop rotation, excluding plants of the beet family for two or three years. *Calendula* rust (*Puccinia calendulae*) and leaf spot (*Entyloma calendulae*) [ibid., xvi, p. 633] may be controlled by destroying all self-sown seedlings; using new soil or soil disinfected by heat or formalin for successive plantings; dusting the plants thoroughly, at the first sign of rust, with finely divided sulphur, or alternatively spraying with one of the available colloidal sulphurs; and by removing and burning all affected plants at the close of the season.

Plant diseases.—*Rep. Wis. agric. Exp. Sta. 1935–36* (*Bull.* 438), pp. 106–120, 7 figs., 1937. [Received April, 1938.]

This report [cf. *R.A.M.*, xv, p. 2] contains the following items of interest besides those already noticed from other sources. In trials conducted over two years at Antigo and Arnott, green manuring reduced potato scab [*Actinomyces scabies*] only inconsiderably, if at all, though it definitely increased yields [ibid., vi, p. 684 *et passim*]. The potato varieties White Rural, Russet Rural, and Russet Burbank were superior

to other common varieties in scab resistance tests [ibid., xvii, p. 483], and several of the tested varieties, which were for other reasons of little or no practical value, were even more resistant than Russet Burbank and may be found suitable for parent stock in breeding scab-resistant varieties.

R. G. Shands found that *Gibberella saubinetii* survived eight months after harvest in 92 per cent. of kernels of scabbed barley [ibid., xvi, p. 805] grown during 1930; it survived 13 months in 57 per cent., 16 months in 24 per cent., 18 months in 8 per cent., and 27 months in 0·5 per cent. of the kernels and lost its viability completely 30 months after harvest. Similar results were obtained with barley grown in 1931. Of other fungi present on the barley *Alternaria* was apparently dead after 63 months, and species of *Helminthosporium*, causing head blight, were dead after 51 months. Scabbed barley fed to hogs 56 months after harvest and 26 months after the scab fungus had lost its viability still caused vomiting; diseased grain should preferably be fed to cattle, sheep, or poultry, but if it must be given to hogs the scabbed barley should be mixed with other feeds and not exceed 10 per cent. of the ration. Scab was found to injure the malting quality of barley by affecting germination, vigour of growth, and chemical composition of the grain, and fungus growth during the malting process caused discoloration of the malt.

J. C. Walker, O. C. Whipple, and V. Wright found *Septoria* leaf blight [*S. lycopersici*] to be the most destructive tomato disease [ibid., xvii, p. 217] in Wisconsin, causing almost complete late-season defoliation of the plants in about 90 per cent. of the affected fields. The source of infection was traced in most cases back to the seed and transplant beds. The control measures recommended include disinfection of all flats and benches, use of new or sterilized soil, spraying the plants with Bordeaux mixture, cleaning the greenhouse, hot-beds, and transplant beds of all plant material after transplanting, and keeping them free from weeds during the summer.

J. C. Walker developed several lines of the Wisconsin All Seasons variety of cabbage completely resistant to yellows [*Fusarium conglutinans*: ibid., xvii, p. 218]. Cabbage mosaic [ibid., xvii, pp. 426, 574] is reported to have caused severe yield reductions when the infection occurred at an early stage of plant growth, while mild infection in the head stage interfered with seed development and caused high seed losses in the more susceptible varieties. The variety Marion Market appeared to be most severely affected by the disease. Of the 2,600 cabbage plants tested for resistance to club root [*Plasmodiophora brassicae*: ibid., xvii, p. 426], only three survived repeated tests and the offspring of these individuals will also be tested.

J. C. Walker, O. C. Whipple, and W. Virgin record the occurrence of tomato spotted wilt attacking peas [ibid., xvi, p. 134]. An unknown virus, designated virus No. 729, produced a streak disease of peas resembling that caused by spotted wilt but differing in certain details. This virus is transmitted by the peach aphid [*Myzus persicae*], and is possibly a strain of the common cucumber mosaic, producing almost identical symptoms on a large number of the same hosts, although the symptoms differ on tobacco. Another virus, No. 408, also causes a streak disease of peas, though less severe than the first two, from both of

which it differs in attacking beans, causing a severe mosaic; it is also believed to be a strain of cucumber mosaic.

The results of spraying tests, conducted by G. W. Keitt and J. B. Carpenter, showed that for the control of fireblight of apple [*Erwinia amylovora*: ibid., xvi, p. 391; xvii, p. 535] summer spraying alone is not sufficient, but that it will possibly prove valuable in combination with other measures. Only copper fungicides were effective, however, no plot sprayed with these being severely blighted, whereas trees sprayed with lime-sulphur were just as badly diseased as those unsprayed.

The inoculation of tomato plants with pathogenic crown gall [*Bacterium tumefaciens*] bacteria showed effects similar to those produced by the so-called plant hormones [cf. next page], e.g., bending down of leaf petioles (epinasty), formation of root initials and of roots, stimulation of the cambium, and suppression of abscission layer formation at the petiole bases, and of axillary bud development on decapitated plants [cf. ibid., xvi, p. 730]. The accumulated evidence indicates that a diffusible substance from a pathogenic crown gall can pass down a tomato stem and influence the point where a crown gall develops [ibid., xvii, p. 224] and that crown gall cultures may produce growth-stimulating materials from tryptophane [cf. ibid., xvi, p. 591].

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1936–37*, Part I, pp. 108–128, 2 figs., 1937. [Received June, 1938.]

Two newly distributed wilt [*Fusarium bulbigenum* var. *niveum*: *R.A.M.*, xvi, p. 439]-resistant varieties of watermelon, Improved Kleckley Sweet No. 6 and Improved Stone Mountain No. 5, are stated to have been widely grown in 1936 and to have given satisfactory results.

H. C. Murphy states that in nursery trials in 1936 at Ames and Kanawha the oat varieties Black Mesdag, Brunker, Markton, Victoria, Navarro, Fulghum, and *Avena strigosa* were uniformly resistant to all the 57 collections of smut [*Ustilago avenae* and *U. kolleri*: loc. cit.] from different Iowa counties; Bond developed 2·8 per cent. infection with one collection. In greenhouse tests Victoria×Richland (C.I. 3311) and *A. strigosa* (C.I. 1782) were resistant to all the collections, and Black Mesdag, Bond, Navarro, Red Rustproof, and Victoria were either completely or highly resistant; Fulghum and Markton were each susceptible to different single collections. A collection of a rare buff-coloured smut, obtained from field-grown oats in 1936, produced 100 per cent. infection on the varieties Black Diamond, Canadian, and Richland.

C. S. Reddy states that treatment of oat seeds nearly free from smut [*U. avenae* and *U. kolleri*] with new improved ceresan increased the yields in 1934 and 1935, but failed to do so in 1936.

According to I. E. Melhus commercial sweet potato varieties showed marked differences in their relative resistance to stem rot (*Fusarium oxysporum* f. 2 and *F. bulbigenum* var. *batatas*) [ibid., xvi, p. 440] in tests, in which disinfected slips, selected from apparently healthy hills, were inoculated with the organisms; the varieties Prolific, Maryland Golden, Muscatine No. 1, and Muscatine No. 2 were moderately resistant, while Yellow Jersey, Edris, Vineless, Nolte Porto Rico, and Muscatine No. 3 were very susceptible. Preliminary tests with inoculated plants

of these varieties indicated that treatment of the slips with a solution of 1 lb. improved semesan Bel in 15 gals. water at transplanting time was effective in controlling stem rot regardless of the susceptibility of the variety. The most resistant varieties, Prolific and Muscatine No. 1, showed an increase from slip treatment of 68·2 and 67 per cent., respectively, in their final stand; an average of 74·8 per cent. of the inoculated and treated plants survived, compared with only 29·8 per cent. for the untreated. Inoculated and treated plants showed an average increase of 72·5 per cent. over the inoculated and untreated in the final stand from slip treatment.

Melhus also gives an account of investigations of the physical, chemical, and biological properties of the bacteriophage of *Pseudomonas* [*Bacterium*] *tumefaciens* [ibid., xvii, p. 380], with a view to using it in the control of crown gall in fruit tree nurseries. It was shown that the bacteriophage may be maintained in culture in a medium consisting of 3 gm. beef extract, 2·5 gm. peptone, and 2·5 gm. sodium chloride in 1 l. water. Ten c.c. of the medium inoculated with 100,000,000 bacteria and 0·5 c.c. of filtrate from the bacteriophage culture gave the optimum phage production when incubated at 25° C. It was shown that the bacteriophage may be recovered from galls on tomato, marguerite [*Chrysanthemum frutescens*], and sugar beet; it was not recovered, however, from galls on castor bean [*Ricinus communis*], peach, and *Bryophyllum*, and was never obtained from healthy plants. When present in the tomato galls, it was also recoverable from the tomato stem up to a height of 15 in. above the gall. In tests with 15 strains of *Bact. tumefaciens*, the phage lysed all the highly and some of the medium virulent strains, but had no action on all the strains of low virulence and on some of those of medium virulence. Further tests showed that the phage was still active at a dilution to 1×10^{-11} and survived heating at 90° for 10 minutes. It lysed the bacteria at all the temperatures and P_H values allowing the growth of the bacteria, and retained its activity after keeping at 5° for 305 days in the absence of the susceptible organisms. It withstood rapid desiccation at temperatures under 60°, was not precipitated by acetic acid or ammonium sulphate, and was insoluble in alcohol, chloroform, ether, butyl alcohol, and acetone. It retained its activity after exposure to 70 per cent. alcohol for 6 hours, 95 per cent. alcohol for 1 hour, 1/40 phenol for 1 hour, 1/3,000 nitric acid for 1 hour, N/64 sodium hydroxide for 1 hour, and 1 per cent. hydrogen peroxide for 72 hours.

HARRIS (R. V.) & PEARSE (H. L.). **The crown gall disease of nursery stocks. III. A progress report on experiments from 1929 to 1937 to determine the relative susceptibility of Malling Apple stocks and including the production of galls by synthetic growth substances.**— *Rep. E. Malling Res. Sta., 1937*, pp. 187–193, 1 pl., 1938.

In continuation of studies on crown gall (*Bacterium tumefaciens*) of apple, initiated in East Malling in 1929 [*R.A.M.*, xi, p. 47], various rootstock varieties were either inoculated with pure cultures of *Bact. tumefaciens* or treated with lanoline paste containing 2 per cent. indolebutyric acid [cf. ibid., xvii, p. 224]. Following inoculations with the bacterium the percentage of trees developing galls varied with the

variety of rootstock, Malling No. II being the most susceptible, No. VII almost equally so, No. I comparatively resistant, and No. XVI highly resistant, and with the date of inoculation, more galls being generally produced when the trees were inoculated after the dormant period. Inoculation with *Bact. tumefaciens* had a measurable stimulating effect on the growth of the host which was irrespective of the formation of galls but varied with the variety of rootstock and the date of inoculation, while parallel treatment with 2 per cent. indolebutyric acid resulted in the formation of galls of uniform size, irrespective of the variety of the stock and the date of application, and caused a significant depression in the growth of stock No. II, though it had no effect on Nos. VII and XVI. The variability of gall formation following inoculation with *Bact. tumefaciens* is probably explained by the failure of the organism to produce a gall-forming substance in the absence from the host of some inactive precursor substance A (possibly tryptophane [ibid., xvii, p. 448; and above, p. 658]) from which the active gall-forming substance B can be derived. It is suggested that the etiological factors affecting the growth of the host are distinct from those determining the initiation of a gall.

HILDEBRAND (E. M.). **Growth rates of phytopathogenic bacteria.**— *J. Bact.*, xxxv, 5, pp. 487–492, 1938.

The growth rates of seven strains of the fireblight organism, *Erwinia amylovora* [see above, p. 658], five from various parts of the United States and one each from Canada and New Zealand, were determined in nutrient broth at 30° C., and the generation time found to range from 71 to 94 minutes, with an average of 82 and a mean deviation between parent and progeny isolates of $-1 \pm 2{\cdot}8$ minutes. The species is thus considerably slower growing than *E. carotovora*, the generation times of which were found by M. M. Mason (*J. Bact.*, xxix, p. 103, 1935) to be 57 and 42 minutes on plain and glucose broth, respectively.

Of 11 species of *Phytomonas* studied from the same standpoint, only one, *P.* [*Pseudomonas*] *utiformica* [*R.A.M.*, xvi, p. 328], required less than an hour (55 to 59 minutes) for generation, *Phytomonas* [*Pseudomonas*] *syringae*, sometimes regarded as identical with the foregoing [ibid., xvi, p. 329; xvii, p. 578], coming next with 73 minutes. The generative velocity of *Phytomonas apii* [*Bacterium jaggeri*] [ibid., xiv, p. 143], *P.* [*Bact.*] *flaccumfaciens* [ibid., xiv, pp. 430, 565; xv, p. 399], and *P.* [*Bact.*] *tumefaciens* was found to range from 78 to 85 minutes, corresponding roughly with that of *E. amylovora*. The generation times of *P.* [*Bact.*] *phaseoli* [ibid., xvi, p. 590; xvii, pp. 297, 369], *P.* [*Bact.*] *pruni*, *P.* [*Aplanobacter*] *michiganense* [ibid., xvii, p. 376], and *P.* [*Bact.*] *rhizogenes* [ibid., xvii, p. 18] were in the neighbourhood of two hours, while an unnamed organism causing cane gall of black raspberry [*Rubus occidentalis*] made the slowest growth of all (2 hours 35 minutes).

While the use of special media (potato-glucose and potato-mannitol apparently influenced the generation time of certain bacteria to some extent, the observed differences may not be significant and are possibly open to another interpretation. In the case of a Virginian culture of *E. amylovora*, for instance, loss of pathogenicity to pear fruits coincided with a decrease of five minutes in the period required for generation.

These data point to a very close relationship between the slow

growing *Phytomonas* and *Pseudomonas*, whereas the position of *Erwinia* is less clearly defined.

HAVAS (L.). **L'action de la colchicine sur le développement du 'phytocarcinome' de la Tomate. Essai d'interprétation du mécanisme de l'action de la colchicine.** [The action of colchicin on the development of the 'phytocarcinoma' of the Tomato. An attempt to interpret the mechanism of the action of colchicin.]—*Bull. Ass. franç. Cancer,* xxvi, 6, pp. 635–662, 5 figs., 1 graph, 1937.

The administration of colchicin (1 in 10,000) to Kondine Red and Best of All tomato plants previously inoculated with the crown gall organism (*Bacterium tumefaciens*) at the Faculty of Medicine, University of Brussels, induced a noteworthy retrogression in the resultant tumours, presumably through the agency of specific stimulatory hormones [cf. *R.A.M.*, xv, p. 82].

OGILVIE (L.). **Cereal diseases in the Bristol Province.**—*Rep. agric. hort. Res. Sta. Bristol, 1937*, pp. 110–117, [1938].

Brief, popular notes are given on the symptoms and control of the chief diseases found on wheat, barley, and oats in the Bristol advisory province.

MÜLLER-KÖGLER (E.). **Untersuchungen über die Schwarzbeinigkeit des Getreides und den Wirtspflanzenkreis ihres Erregers (Ophiobolus graminis Sacc.).** [Studies on cereal blackleg and the host range of its agent (*Ophiobolus graminis* Sacc.).]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxii, 3, pp. 271–319, 13 figs., 1 graph, 1938.

Continuing his studies on the blackleg form of cereal root rot caused by *Ophiobolus graminis* [*R.A.M.*, xiv, p. 157; xvii, p. 592] in Germany, the writer ascertained by observations and experiments on plants in sterilized and unsterilized soil of various types that the fungus is practically innocuous to v. Lochow's yellow oats, causes little damage to Petkus rye, attacks Ackermann's Isaria barley severely, and is intensely pathogenic to Peragis wheat. The degree of resistance appears to be correlated to some extent with the nature of the endodermal cell walls and the formation of 'lignitubers' in the host roots [ibid., xi, p. 708], but neither chemical nor anatomical peculiarities could be found to explain the varying reaction of the four cereals to *O. graminis*. All the plants were more virulently infected in an inoculated sterilized sandy clay-sand mixture than in inoculated unsterilized soil, the milder symptoms in the latter being attributed to delay in the establishment of contact between the pathogen and the roots and the relatively slow and scanty growth of the fungus. Inoculated three-weeks-old wheat and barley plants were more severely attacked in sterilized compost than in a sterilized sandy clay-sand mixture, presumably due to the superior aeration in the former promoting fungal development, whereas in the case of rye the relationship was unaccountably reversed and oats sustained equally little injury in either soil type. At the age of $2\frac{1}{2}$ months, however, the inoculated cereals were less heavily infected in the sterilized compost than in the sterilized sandy clay-sand mixture. The introduction into the sterilized sandy clay-sand mixture of

suspensions of compost and *Bacterium prodigiosum* substantially reduced the incidence of infection by *O. graminis*, but the bacterial inoculum caused damage to the wheat plants. The reinoculation of a sterilized Fehmarn [island off Schleswig-Holstein] soil with unsterilized soil restored to the former a measure of its natural protective action against blackleg.

Poor barley yields are believed to be more often due to infection by *O. graminis* than is commonly recognized, especially where the crop follows wheat. Generally speaking, the influence of the preceding crop in relation to blackleg is conditioned by the susceptibility of the roots to the destructive action of the mycelium, while barley is also an unsuitable previous crop owing to its adverse effect on the soil tilth. Stable manure for the control of the disease should only be applied in a well-rotted state, preferably to the crop preceding that requiring protection.

None of the 73 dicotyledonous plants examined for their reaction to *O. graminis* in the sterilized sandy clay-sand mixture was infected to any appreciable extent. They may be divided into four groups according to the nature of the injury caused by the parasite, namely, (1) characterized by complete absence of mycelium from the root system; (2) fungal growth practically restricted to the exterior of the root system; (3) the primary root cortex (mostly excluding the endodermis) offers no apparent resistance to rapid hyphal invasion, but with the formation of a pericyclic epidermis the primary cortex is sloughed off and the mycelium simultaneously disappears; and (4) the primary root cortex is deeply penetrated, but the attacks (mostly localized) are promptly repelled, presumably through the agency of defensive reactions. The formation of perithecia or their rudiments was observed on plants of the second (*Chrysanthemum segetum*), third (*Scleranthus annuus* and *Chenopodium album*), and fourth (*Convolvulus arvensis*) groups, and is thus apparently independent of the degree of fungal infestation of the roots. From these observations it would appear that none of the dicotyledons used in the tests plays an important part in the spread of blackleg in the field.

Newton (Margaret). **The cereal rusts in Canada.**—*Emp. J. exp. Agric.*, vi, 22, pp. 125–140, 1 graph, 1938.

This is a general account of the cereal rusts (*Puccinia graminis*, *P. triticina*, *P. glumarum*, *P. coronata* [*P. lolii*], *P. anomala*, and *P. dispersa* [*P. secalina*]), of Canada, based on outstanding contributions of recent years, practically all of which have been noticed in this *Review*. The aspects discussed include the distribution and perpetuation of the rusts, the losses caused by them, the distribution and prevalence of the physiological races, the relation of the barberry to the distribution of the physiologic races, and rust resistant varieties.

In 1937 the Thatcher and Renown wheat varieties [*R.A.M.*, xvii, p. 101] yielded in many parts of Manitoba from 30 to 40 bush. per acre and graded No. 1 Northern, whereas the two commonly grown standard varieties, Marquis and Ceres, yielded in the same localities an average of about 12 bush. per acre; further, much of the grain yielded by Marquis and Ceres was so shrunken by stem [black] rust [*P. graminis*]

that it had to be placed in special grades owing to its light weight per bushel. During the past year an oat variety resistant to black rust, Vanguard, a selection developed at the Dominion Rust Research Laboratory from a cross between Banner and Hajira, was distributed in the prairie provinces. The introduction of these new varieties would appear to mark a new era in cereal-growing in western Canada.

HASSEBRAUK (K.). **Weitere Untersuchungen über Getreiderostbekämpfung mit chemischen Mitteln.** [Further investigations on cereal rust control by chemical means.]—*Phytopath. Z.*, xi, 1, pp. 14–46, 1938.

On the basis of results obtained in previous experiments [*R.A.M.*, xvi, p. 236], 16 organic substances of known constitution containing nitro groups or sulphur were tested in the greenhouse for their toxicity to *Puccinia triticina* and *P. glumarum* on Michigan Amber and Strube's Squarehead wheat, *P. graminis tritici* on the former variety, *P. simplex* [*P. anomala*] on Friedrichswerth Berg winter barley, *P. dispersa* [*P. secalina*] on Petkus rye, and *P. coronata* [*P. lolii*] on Beseler's white oats. The chemical compounds were strewn over the surface of the soil in pots a few days before planting seedlings inoculated with highly pathogenic races of the rusts. The only ones affording complete control were p-toluolsulfonamide and o-toluolsulfonamide, the latter especially exerting a powerful action even at minimal concentrations, e.g., 0·6 mg. per 100 sq. cm. in the case of *P. triticina*, the corresponding figure for the former being 30 mg. These compounds, however, are apt to cause severe injury to the plants, comparing unfavourably in this respect with the moderately effective picric acid. The action of p-toluolsulfonamide on a single race (C) of *P. triticina* on 25 wheat varieties was absolutely uniform. The admixture of humus with the soil, especially in the form of peat, greatly reduced and in certain cases entirely neutralized the toxicity to rusts of some of the more promising compounds.

Carbolineum and other tar-oil products may exercise a strong repressive influence on rust development, probably through the secretion of volatile substances directly inhibiting fungal growth, but their action is subject to unpredictable variations due to external conditions, and they have the further disadvantage of an unfavourable chemotherapeutical index.

Similar objections apply to borax, the rust-reducing action of which reported by Gigante [ibid., xv, p. 350] was confirmed by the writer's tests.

GASSNER (G.) & HASSEBRAUK (K.). **Untersuchungen über den Einfluss von Äther- und Chloroformnarkose auf das Rostverhalten junger Getreidepflanzen. Ein Beitrag zum Resistenzproblem.** [Investigations on the influence of ether and chloroform narcotization on the reaction to rust of young cereal plants. A contribution to the resistance problem.]—*Phytopath. Z.*, xi, 1, pp. 47–97, 1938.

A comprehensive, tabulated account is given of a series of experiments to determine the influence of ether and chloroform narcotization on the reaction of young wheat plants to *Puccinia triticina* races 14 and 53, *P. graminis* race 79, and *P. glumarum* race 9, and of oats to *P. coronata*

[*P. lolii*] race 59 and *P. glumarum* race 9 [cf. *R.A.M.*, xii, p. 45 and preceding and next abstracts].

The administration of ether was found to exert no definite effect on susceptibility, which was almost uniformly accentuated, on the other hand, by chloroform, e.g., at 0·5 c.c. per 25 l. Even highly resistant varieties subjected to this treatment contracted severe infection, involving profuse fructification of the rusts, while the completely immune type of reaction was altogether absent. These results differ from those of Volk [ibid., x, p. 479] and Minkevičius [ibid., xii, p. 45] who found that narcotization decreases susceptibility to rust. The discrepancy is explained by the fact that these authors interpret alterations in intensity of attack in susceptible varieties as an effect on their susceptibility, whereas reduction in intensity of attack should not be regarded as a change in susceptibility as long as the infection type remains the same. Chloroform narcotization further influenced the development and appearance of the test plants, which frequently showed abnormalities of growth and an intensely dark green coloration due to their increased chlorophyll content. Associated with the latter was an increase of nitrogen, the relation of which to susceptibility constitutes a general phytopathological problem [ibid., xv, p. 350 *et passim*].

According to Chester [ibid., xiii, p. 116], narcotization enhances susceptibility by depriving the host cells of their capacity to secrete substances toxic to the invading organism, but the results of the writers' observations do not bear out this hypothesis. Rust resistance appears to be connected primarily with the production of antibodies neutralizing the fungal toxins and protecting the host cells against their action. In plants with a high nitrogen content, the fungal toxins may be partially neutralized but the growth of the fungus may be stimulated notwithstanding, since the presence of nitrogen is favourable to its nutrition.

GASSNER (G.) & FRANKE (W.). **Einige Versuche über die Beeinflussung des Stickstoffhaushaltes junger Weizenblätter durch den Kohlensäuregehalt der Luft.** [Some experiments on the influence of the carbon dioxide content of the atmosphere on the nitrogen metabolism of young Wheat leaves.]—*Phytopath. Z.*, xi, 1, pp. 98–105, 1 graph, 1938.

Investigations are reported on the influence of the carbon dioxide content of the atmosphere on the nitrogen metabolism of young wheat plants in relation to susceptibility to rust [*Puccinia* spp.: *R.A.M.*, viii, p. 555, xiii, p. 755]. It has been established by several authors that a correlation exists between the carbon dioxide supply to the leaves and their nitrogen content, and this has been confirmed by experiments described in this paper. Previous work has shown that an increase in the carbon dioxide supply resulted in an increased rust attack, which is explained by the increased nitrogen content, and in a final decrease in the rust infection, for which there are no parallel changes in the nitrogen content of the host. The host reactions accompanying this final decreased susceptibility in excessive concentrations of carbon dioxide are quite abnormal, involving suppression of all the intermediate stages of reaction between moderate susceptibility and resistance, and the appearance of white flecks. The phenomenon is entirely un-

connected with modifications in the normal reaction of the plants to infection and must be due to unknown factors not related to the nitrogen content of the leaves.

STRAIB (W.). **Las razas fisiologicas de Puccinia glumarum en Sudamerica y su comportamiento en la infección comparado con el de las formas europeas.** [The physiological races of *Puccinia glumarum* in South America, and their behaviour in infection as compared with that of European forms.]—*Arch. fitotec. Uruguay,* ii, pp. 217–233, 1937. [German and English summaries. Received June, 1938.]

An account is given of experiments carried out since 1935 at Brunswick, Germany, with collections of stripe [yellow] rust (*Puccinia glumarum*) received by air mail from Uruguay [*R.A.M.*, xi, pp. 226, 630] and from Chile and the Argentine [ibid., xvi, p. 372], the results of which showed that at least four different physiological races of the rust, designated as races 30, 37, 38, and 39, occur in South America. All the four races were represented in the collections from Chile; race 30 was found in those from the Argentine and Uruguay, and there was indirect evidence of the presence in the Argentine of race 37; the peculiar behaviour of certain of the wheat varieties tested indicated the presence in the Argentine of still another physiological race which, however, has not so far been isolated from the rust samples. These results are considered to indicate that yellow rust spread from Chile, where its presence was first established in 1919, to the Argentine and Uruguay, where its epidemic occurrence finds a partial explanation in the fact that susceptible wheat varieties are grown in these countries. The majority of German wheat varieties were found to be resistant to the South American races, but both the German and South American physiological races had essentially the same pathogenicity range on the South American wheat varieties. As far as determined, the South American races are specific to wheat, but were experimentally shown to be capable of infecting certain barley varieties and various wild grasses (*Elymus*, *Hordeum*, and *Agropyrum* spp.). The fact that the same order of relationship was established between the virulence of individual German and South American races is held to support the hypothesis that new yellow rust races arise through progressive mutation. The paper includes a list of wheat varieties which the author considers to be adapted for breeding for resistance to yellow rust.

HOLTON (C. S.). **A new pathogenically distinct race derived from a cross between Tilletia tritici and T. levis.**—*Phytopathology,* xxviii, 5, pp. 371–372, 1938.

The reticulate chlamydospores of the interspecific hybrid recently derived by crossing races T_9 of *Tilletia tritici* [*T. caries*] and L_8 of *T. levis* [*T. foetens*] [*R.A.M.*, xvii, p. 505] were inoculated into Hard Federation wheat seed-grain and caused a high percentage of infection. Both parents and F_2 chlamydospores of the hybrid, morphologically resembling the T_9 parent, were inoculated into Hybrid 128, Oro, and Hohenheimer seed-grain with the following results: the bunt hybrid produced 85, 46, and 16 per cent. infection respectively, on the three

varieties in the order named, the corresponding figures for T_9 being 82, 3, and 28, and for L_8 80, 83, and 0·8 respectively. The hybrid thus differs from its parents in attacking both Oro and Hohenheimer to an appreciable extent, while its morphological resemblance to *T. caries* and ability to attack Oro, resistant to all the races of this species hitherto described, are also regarded as significant. Hohenheimer, moreover, is highly resistant to all known races of *T. foetens* and no previously recorded race of either species has been able to infect both these varieties. It would seem, therefore, that a segregate possessing the morphological characters of one parent and certain pathogenic features of both has been derived from a cross between *T. caries* and *T. foetens*.

MARTIN (J. F.) & SPRAGUE (R.). **Relative effectiveness of controlling different physiologic races of bunt by seed disinfection.**—*J. Amer. Soc. Agron.*, xxx, 5, pp. 390–394, 1938.

A tabulated account is given of five years' experiments at two localities in Oregon to determine whether any of the twelve different physiologic races of wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] known to exist in the Pacific North-West [see preceding abstract] are more amenable than others to control by seed-grain (Hybrid 128 and Goldcoin) disinfection by standard preparations. No consistent variations were observed in the relative efficacy of control of any of the races tested, such differences as were detected being greatest where control was poor. A positive relationship was established between the incidence of bunt in the untreated control rows and the efficacy of control by seed-grain disinfection. The best treatments were new improved ceresan, copper sulphate (1 lb. each of copper sulphate and common salt to 5 gals. water, followed by a lime bath), and formaldehyde (1 in 320).

NISIKADO (Y.) & HIRATA (K.). **On the specific gravity methods in grading the Wheat seeds, as a control-means for the seedling blight, caused by Gibberella saubinetii (Mont.) Sacc.**—*Ber. Ōhara Inst.*, viii, 2, pp. 125–145, 1 pl., 4 graphs, 1938.

With a view to the control of wheat seedling blight (*Gibberella saubinetii*) by seed selection, grains were harvested in 1937 from diseased and healthy heads of twelve varieties cultivated in southern Kyushu, Japan [*R.A.M.*, xiv, p. 296], and graded according to specific gravity, absolute weight, and diameter. The grains were first soaked in water and those rising to the surface (being below 1·00 in specific gravity) discarded, while the remainder were successively transferred to aqueous solutions of magnesium chloride with specific gravities of 1·00, 1·05, 1·10, 1·15, 1·20, and 1·24 and ultimately placed in six categories (excluding those below 1·00), viz., (1) specific gravity 1·00 to 1·05, (2) 1·05 to 1·10, (3) 1·10 to 1·15, (4) 1·15 to 1·20, (5) 1·20 to 1·24, and (6) above 1·24.

Germination tests were conducted on sand with a water content of about 50 per cent. of saturation, a temperature of 24° C. being maintained and counts made after 5, 8, and 10 days' incubation. The next step involved the surface sterilization of the grains, first in 50 per cent. alcohol and then in 0·1 per cent. mercuric chloride (2 minutes each), and their subsequent growth on a rice decoction agar medium with

the addition of various carbohydrates; the presence of colonies of *G. saubinetii* was revealed by a red coloration of the medium.

It was found that the average infection (as manifested by the presence of internal hyphae) of twelve varieties for grains of specific gravity below 1·00, and the six other categories, was 29·0, 20·2, 13·0, 12·7, 7·6, 4·3, and 0·5 per cent., respectively, the percentages of wheat grains found in each of the classes being 20·7, 3·7, 4·9, 5·6, 8·0, 8·8, and 48·4, respectively. On the variety Hatakeda diseased grains were 20 to 25 mm. in diameter whereas the healthy were 25 to 27 mm. Grains with a specific gravity exceeding 1·24 germinated very satisfactorily—with an average percentage of over 91·6 per cent. for most of the varieties tested, while no internal hyphae of *G. saubinetii* were present, except in Hatakeda and Pusa No. 12. Grains with specific gravity above 1·20, even when originating on blighted heads, may safely be sown as seed for the next generation, but surface sterilization should be practised in order to eliminate possible external contamination by the hyphae or spores of the fungus.

Gassner (G.) & Kirchhoff (H.). **Einige abschliessende Versuche über die Wirkung der Warmbenetzungsbeize.** [Some final experiments on the effect of the hot-water moistening method of disinfection.]—*Phytopath. Z.*, xi, 2, pp. 115–120, 1938.

In this final contribution to their studies on the hot-water moistening method of grain disinfection for the control of loose smut of wheat and barley [*Ustilago tritici* and *U. nuda*: *R.A.M.*, xv, p. 787] the authors describe a few unpublished experiments on the effect of different steeping and presoaking periods, the results of which are in full agreement with previous data, and sum up the conclusions arrived at as follows: the amount of fluid per 50 kg. of grain must be not less than 6 l.; the addition of 1 per cent. methylated spirit ensures the fungicidal effect without impairing the germination; the period of presoaking should be either 4 hours at 20° C. or 7 to 8 hours at 10°; and the treatment itself should occupy one hour at 54° to 55°.

Tapke (V. F.). **Influence of environment, after seedling emergence, on covered smut in Barley.**—*Phytopathology*, xxviii, 5, pp. 370–371, 1938.

The following results were obtained in October, 1936, at Arlington, Virginia, in experiments with formaldehyde-treated seed-grain of Tennessee and Wisconsin Winter barleys inoculated with covered smut (*Ustilago hordei*) [*R.A.M.*, xvii, p. 308] by dusting with spores and also by the spore suspension method [ibid., xv, p. 210]. Field and greenhouse plants from the uninoculated (control) lot of seed were smut-free, those from the batch inoculated by the spore suspension method contracted a high incidence of infection (72 to 74·7 per cent.), while superficial dusting with spores produced different results according to the post-emergence treatment of the seedlings, those immediately placed outdoors contracting only 27·8 per cent. while those first subjected to greenhouse conditions for a fortnight or a month developed 55·1 and 65·3 per cent., respectively. Greenhouse plants from spore-dusted seed showed 63·9 per cent. infection.

It seems apparent from these results that the spore suspension method of inoculation, involving the lodging and germination of the spores beneath the hulls, enables the smut to become sufficiently entrenched within the host tissues to resist adverse post-emergence conditions, which may, however, well delay the penetration into the interior of the hyphae developing from spores superficially dusted over the seed. This may account for the discrepancy between the low field and high greenhouse incidence of covered smut obtained in spore-dusting inoculation tests on barley by J. A. Faris in 1924 [ibid., iv, p. 214].

GREANEY (F. J.), MACHACEK (J. E.), & JOHNSTON (C. L.). **Varietal resistance of Wheat and Oats to root rot caused by Fusarium culmorum and Helminthosporium sativum.**—*Sci. Agric.*, xviii, 9, pp. 500–523, 1 graph, 1938.

After briefly referring to their previous papers on the root rot problem of cereals in Canada (*Fusarium culmorum* and *Helminthosporium sativum*) [most of which have been noticed here: *R.A.M.*, xiv, p. 298; xvi, p. 307; *et passim*], the authors give a summarized account of tests from 1930 to 1936 of several standard varieties and a large number of rust-resistant selections of spring wheats, for resistance to root rot caused by both fungi, and of tests from 1934 to 1936 of ten standard varieties and rust-resistant strains of oats to root rot caused by *F. culmorum*. The tests were carried out in the Root Rot Garden of permanent, artificially infected plots at Winnipeg and in field trials under artificially induced and natural epidemics at different stations in Manitoba. It was found that the ability of the wheat seed-grain to produce young plants was highest in the wheat varieties and selections that were most resistant to root rot, and lowest in the most susceptible ones. All the standard varieties, as well as most of the rust-resistant wheats, proved to be markedly susceptible to root rot, though significant differences were apparent between varieties in their reaction to the disease. The variety Mindum and a few selections with Mindum parentage were most susceptible to root rot, while a few of the rust-resistant selections, particularly Apex and Thatcher, proved to be the most resistant. In general, it was established that in any given year the varieties susceptible to *F. culmorum* consistently retained their susceptibility independently of the wide range of field conditions under which they were grown, while the most resistant varieties consistently remained the most resistant. The latter varieties were also fairly consistently resistant to *H. sativum*, while susceptibility to either of these fungi was significantly associated with susceptibility to the other. The results of the tests with oat varieties showed that they varied significantly in their reaction to *F. culmorum*; Ohio and Victoria and the rust-resistant hybrid Hajira × Banner (Selection 13) were most resistant, while the standard varieties Victory and Banner were the most susceptible.

SOUKHOV [SOUKHOFF] (K. S.) & VOVK (A. M.). **Mosaic disease of Oats.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xix, 3, pp. 207–210, 2 figs., 1938.

The authors give an account of their investigations of the condition of oats described from Siberia under the name 'zakooklivanie' ['pupation': *R.A.M.*, xiv, p. 493], the results of which showed that the first symp-

tom of the disease to become apparent is the development of light green stripes and spots on the leaves and leaf sheaths; in 1937 this symptom appeared on the 18th day from sowing in oats sown both on the 5th and on the 29th July, indicating that probably the incubation period remains constant under different meteorological conditions. The other macroscopical symptoms [loc. cit.] develop much later, and are almost invariably accompanied by the mosaic pattern on the leaves and leaf sheaths; the latter symptom, however, has a tendency to become masked under the influence of dryness or high temperature of the air. Field observations indicated that diseased plants are very irregularly dispersed among the healthy, without the formation of any definite infection foci, and that the incidence and severity of the disease decrease considerably in the later sown oats. Cytological studies showed the presence of vacuolate bodies similar to those found in mosaic wheat [ibid., xvi, p. 665] and of spindle-shaped crystals, probably of protein nature, in the epidermal cells. Further studies revealed considerable disturbances in the vascular system of diseased oat plants, and considerable necrosis of the phloem of stunted plants, sometimes spreading to the neighbouring portions of the parenchyma. In slightly affected plants the phloem is not necrosed but is weakly developed. The total nitrogen content of stunted oat plants was found to be 2·7 to 3·03 per cent., as against 1·5 to 1·7 per cent. in healthy plants.

These investigations are held to have confirmed the view of previous workers that 'zakooklivanie' is due to a virus, and the fact that out of 3,773 oat plants grown under gauze cages only six developed the disease, presumably owing to the accidental intrusion of a carrier in two of the cages, would indicate that infection is not carried in the soil but is distributed by some as yet undetected insect.

All the varieties of *Avena sativa*, *A. strigosa*, and *A. byzantina* tested by the authors were found to be susceptible to the disease, which was also reported by another worker on *A. fatua* and *A. sterilis*.

BALKS (R.) & WEHRMANN (O.). **Magnesiamangelerscheinungen bei Feldversuchen zu Winterroggen auf leichtem Sandboden in Braunschweig.** [Magnesium deficiency symptoms in field experiments with Winter Rye on a light sandy soil in Brunswick.]—*Ernähr. Pfl.*, xxxiv, 9, pp. 145–147, 6 col. figs., 1938. [English and Spanish summaries on p. 164.]

In connexion with a fertilizing experiment on winter rye on a strongly acid (P_H 4·4) light sandy soil in Brunswick (Germany) in 1937, the plants deprived of magnesium contracted a disease characterized in the initial stages by localized accumulations of chlorophyll in the leaves, followed by the development of a yellowish to brownish mottling [cf. *R.A.M.*, xvii, p. 385] and a red discoloration of the leaf tips and margins, which tended to curl inwards. Plants transferred to pots at an early stage of the disorder and supplied with magnesium sulphate at the rate of 0·5 gm. per pot were cured in five days.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1936–37*, Part II, pp. 51–58, 1937. [Received June, 1938.]

I. E. Melhus and G. N. Davis give a brief account of an experiment

started in 1935 to determine whether the relation observed in maize between the development of axillary buds and the abundance of nodal infection with smut (*Ustilago zeae*) [*R.A.M.*, xiv, p. 750; xv, p. 712] also obtains in smuts on other Gramineae. The results showed that the removal of the mature heads from sorghum plants raised from seed heavily infected with covered kernel smut (*Sphacelotheca sorghi*) [ibid., xvii, pp. 16, 453], appeared to stimulate the development of axillary and adventitious buds in almost endless profusion, each new culm being potentially capable of producing one or more smutted heads. It was further found that the behaviour of *S. sorghi* in its host is apparently much the same as that of maize smut in the maize plant, inasmuch as occasional smut-free heads are produced on plants on which all the other heads are smutted, though it differs from the maize smut in that it is a true systemic smut.

I. E. Melhus reports further investigations on the development, nature, and action of the *Diplodia zeae* inhibitor (autotoxin) [ibid., xiv, p. 751], the results of which indicated that the responsible substance or substances belong to the complex amines or betaines, and are non-volatile. It was further demonstrated that the inhibitor was present in maize plant material seven days after artificial infection of the plants with *D. zeae*, and that it had a delaying action on the germination of *D. zeae* spores collected in the field.

C. S. Reddy states that further studies of the *Basisporium* dry rot of maize [ibid., xvi, p. 310] showed that in a year of high infection (1935) with the pathogen the small-spored species (*Nigrospora oryzae*) predominated, whereas in a year of low infection, such as 1936, the large-spored *N. sphaerica* was predominant. Almost complete domination of one species over the other occurred in those two years.

Larsh (H. W.). **Relative prevalence of Diplodia zeae and Diplodia macrospora on Corn.**—*Plant Dis. Reptr*, xxii, 9, pp. 159–162, 2 maps, 1938. [Mimeographed.]

Isolations from 200 apparently diseased kernels selected macroscopically from eleven samples of maize received in the United States in various shipments from the Argentine gave *Diplodia zeae* and *D. macrospora* [*R.A.M.*, xvi, p. 739; xvii, pp. 238, 452] in 45 and 2 instances, respectively. In random samples of diseased maize stalks collected in the field early in 1938 in Alabama, Florida, Georgia, South Carolina, and Tennessee the same two fungi occurred 653 and 15 times, respectively, and *D. frumenti* (*Physalospora rhodina*) 11 times. In 1930, Eddins [ibid., ix, p. 712] made similar observations on the relative frequency of these fungi in Florida, finding that out of 618 diseased maize stalks 496 showed the presence of *D. zeae*, 102 that of *D. macrospora*, and 20 that of *D. frumenti*. Cultures from diseased maize ears collected by the author at the same time as the stalks and from other samples received from North Carolina, Tennessee, and Louisiana gave *D. zeae* and *D. macrospora* in 390 and 16 instances, respectively.

It is concluded that *D. zeae* is much more widely distributed than *D. macrospora* in the United States and is much more commonly present than the latter wherever the two fungi are found.

MEIJERS (P. G.). **Einige waarnemingen over de Maisroest.** [Some observations on Maize rust.]—*Landbouwk. Tijdschr., Wageningen*, 1, 612, pp. 451–454, 1 diag., 1938. [German summary.]

In the course of a varietal experiment with seed maize at the State Agricultural Experiment Station, Noordlaren, Groningen, Holland, in 1937, an outbreak of rust (*Puccinia maydis*) [*R.A.M.*, xvii, p. 452] developed (for the first time in the locality) on the early North American variety Gehu and rapidly spread to a number of other early maturing sorts, e.g., Mecklenburg, Pomerania, Blanc des Landes, and Nano précoce Succi, while a selection of the Dutch Moorland Association, Giersdörf, Minnesota 23, Northwestern, and Précoce C.C. were relatively resistant, and the late ripening Précoce cinquantino F.S., Minnesota 13, and Yellow Baden Land remained free from infection.

KLOTZ (L. J.) & BASINGER (A. J.). **The influence of various types of rind injury on the incidence of water spot of Navel Oranges.**—*Bull. Dep. Agric. Calif.*, xxvii, 2, pp. 232–241, 2 figs., 1938.

In this paper the authors describe the experiments and give the data on which former conclusions, already noticed from another source [*R.A.M.*, xvii, p. 390], were founded. In experiments conducted in 1935 and 1937 Navel oranges were entirely immersed in tap water for 18 to 19 hours (or partially immersed for periods of up to 5 days, the exposed navel ends being covered with wet cloth) and subsequent examination showed that the presence of fresh wounds caused by thorn and twig punctures, sand, hail, wind, or resulting from frost or oil sprays increased the incidence of water spot, while the presence of old, healed scars due to *Thrips*, *Tortrix*, Katydids, rubs, scratches, and chemical burns had no effect. The occurrence of both insect scars and water spots in the same area is often not interrelated. Field counts carried out in 1937 confirmed the experimental results.

BAKER (R. E. D.). **Red root disease of Limes in the British West Indies.**—*Trop. Agriculture, Trin.*, xv, 5, pp. 105–108, 1938.

The author sums up the present extent of our knowledge of the red root disease of limes [*R.A.M.*, xv, pp. 2, 717], destructive outbreaks of which occurred in Dominica (1927), Montserrat (1933), and St. Lucia (1934). No conclusive evidence as to the status of *Sphaerostilbe repens* as a primary cause of the disease has yet been found and the part played possibly by other fungi, the citrus weevil, hurricanes, and other metereological conditions require further investigation. In recent studies by the author in St. Lucia, some 60 trees were dug up and their roots examined. Of 44 dead and dying seedling trees present, 19 showed no trace of *S. repens*, 15 showed only traces of the fungus on dead roots which must have died from some other cause, and 10 showed the fungus in considerable quantity. The author thinks that, though the fungus may behave as a parasite under certain conditions, it is more often found as a saprophyte, and that factors predisposing the seedling lime trees to attack by *S. repens* are of more importance than the presence of the fungus itself. It has been previously recommended by Briton-Jones (in an unpublished report) and is again advised by the author that lime trees should be planted budded on the sour orange resistant

to red root disease and gummosis [chiefly *Phytophthora parasitica*: ibid., xvi, p. 312], taking great care to ensure that the seeds come from the true sour orange and not from various other citrus varieties similar in appearance but susceptible to these diseases. Furthermore, the sour orange in Trinidad is subject to a totally unexplained root disease and it is suggested that a study of this disease and of the different types of citrus used for stocks should be made with a view to determining the best stock for each area.

BAHRT (G. M.) & HUGHES (A. E.). **Soil fertility and experiments on bronzing of Citrus.**—*Proc. Fla hort. Soc.*, l, pp. 23–28, 1937. [Abs. in *Chem. Abstr.*, xxxii, 12, p. 4709, 1938.]

Studies on the chlorotic condition of citrus foliage known as 'bronzing' in Florida [*R.A.M.*, xiv, p. 442] showed that the affected leaves occur mostly on the next-to-youngest growth or early spring flush. Four distinct types of the disorder were observed and are described. As the stages of bronzing advanced the magnesium content of the foliage decreased and the calcium : magnesium ratio increased. Where magnesium was applied to the soil in supplements to complete fertilizers bronzing decreased and the maximum fruit yields were usually obtained from the least affected trees. The most promising treatments for the control of the disease were calcined kieserite, dolomitic limestone, manganese sulphate, and ground calcium limestone, supplemented by magnesium sulphate, in addition to a complete fertilizer.

EZEKIEL (W. N.). **Evaluation of some soil fungicides by laboratory tests with Phymatotrichum omnivorum.**—*J. agric. Res.*, lvi, 8, pp. 553–578, 1 fig., 1938.

After briefly describing the methods developed for determining in the laboratory the capacity of fungicides to permeate soil and their fungistatic (growth-inhibiting) and fungicidal efficiency in the control of cotton root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xvii, p. 596 and next abstracts] the author gives a tabulated account of the results so far obtained in these investigations, which were started in 1928 and have already been noticed in part [ibid., xiii, p. 698]. The relative efficacy of a number of organic mercury compounds when mechanically mixed into soil is indicated in a table, as determined in tests with soil inoculated with composite sclerotial material of the fungus in closed jars. The initial fungistatic efficiency of ethyl mercury compounds was found to be much higher than would be expected from their mercury content, but their residual value after five weeks' contact with moist soil was in line with that of other compounds. Similar tests, in which the fungicides were applied to the surface of Houston black clay soil, showed that a group of volatile substances, including pentachlorethane, tetrachlorethane, xylene, carbon disulphide, turpentine, perchlorethylene, trichlorethylene, and dichlorethylene, at the rate of only 100 parts per million of the air-dry soil, completely inhibited growth from inoculum 13·5 cm. deep in the soil. Formaldehyde was ineffective at 4,000 p.p.m., and ammonia did not prevent growth even at 10,000 p.p.m. The organic mercury compounds tested inhibited growth near the surface but not from deeper inoculum. Four to eight weeks' contact of

pentachlorethane with moist surface soil reduced its initial fungistatic efficiency to between one-fifth and one-tenth of the original value. Higher concentrations (500 to 1,000 p.p.m.) appeared to be necessary to ensure the growth-inhibiting action of pentachlorethane, tetrachlorethane, and xylene in very compact soil, or with infected roots used as inoculum, or when the jars were left open and fanned to accelerate the evaporation of the fungicides. In the open jars inserting the substances in holes below the surface appeared to be much more advantageous than surface application. While these substances are suggested for trial in field experiments, none of the compounds enumerated in this report is recommended at this time for practical use against cotton root rot.

EZEKIEL (W. N.). **Tests with pentachlorethane, tetrachlorethane, and xylol to determine their efficiency in eradication of Phymatotrichum root rot.**—*J. agric. Res.*, lvi, 8, pp. 579–593, 3 diags., 1938.

An account is given of field trials conducted over two years in Texas, the results of which are stated not to justify the recommendation of tetrachlorethane, pentachlorethane, or xylol [see preceding abstract] for practical use in the control of cotton root rot (*Phymatotrichum omnivorum*).

EZEKIEL (W. N.) & FUDGE (J. F.). **Studies on the cause of immunity of monocotyledonous plants to Phymatotrichum root rot.**—*J. agric. Res.*, lvi, 10, pp. 773–786, 1 fig., 1 diag., 1938.

In the work summarized in this paper the action of different fractions of the juices expressed from the roots of a number of mono- and dicotyledonous plants was tested on the growth of *Phymatotrichum omnivorum* [*R.A.M.*, xi, p. 640; xii, p. 691; and preceding and next abstracts] in pure culture. The results showed that the ether extracts of juices from the roots of monocotyledons, all of which are immune from the fungus, inhibited the growth of the latter, while those from the roots of susceptible dicotyledons had no inhibitory effect. The aqueous residues of juices from both immune and susceptible plants prevented growth when added to the culture solutions. In the ether extracts from all the monocotyledons tested, growth inhibiting material was found in a fraction with the following characteristics: solubility in ether, from which it cannot be washed by water or precipitated by acetone; solubility in aqueous sodium carbonate solution, from which it is recovered in ether after slight acidification; relative insolubility in petroleum ether as compared to ethyl ether; probable solubility in alcohols. Such fractions were approximately 100 times as potent on a dry matter basis as the original juice, and completely inhibited the growth of *P. omnivorum* when added to nutrient solutions in amounts that supplied from 0·02 to 0·09 per cent. of material. Fractions of this kind were prepared from onion bulbs, gladiolus corms, and from the roots of giant reed (*Arundo donax*), *Canna* sp., *Hemerocallis* sp., and Johnson grass (*Sorghum halepense*). Onion juice was found to contain an additional potent fraction, insoluble in sodium carbonate solution, but apparently slowly saponifiable in alcoholic potassium hydroxide. Potent ether fractions were also found in the juices from the less susceptible potato and turnip varieties, suggesting that these fractions

may be associated with differences in the susceptibility to root rot of various dicotyledonous families and species. The general inference drawn from this work is that the immunity of monocotyledons to root rot is due, at least in part, to the presence in the roots of minute quantities of acidic, ether-soluble substances, possibly organic acids or esters.

TAUBENHAUS (J. J.) & EZEKIEL (W. N.). **A rating of plants with reference to their relative resistance or susceptibility to Phymatotrichum root rot.**—*Bull. Tex. agric. Exp. Sta.* 527, 52 pp., 1936. [Received June, 1938.]

This bulletin supplies information on the relative susceptibility or resistance to the cotton root rot fungus (*Phymatotrichum omnivorum*) [see preceding abstracts] of 2,116 species of plants, belonging to 131 families, arranged alphabetically by their Latin names under each family. The root rot ratings shown in the list are based on the percentage of plants which developed visible symptoms of the disease when exposed to infection under favourable conditions.

BIRAGHI (A.). **Una 'mummificazione' del Cotone causata da Alternaria.** [A mummification of Cotton caused by *Alternaria*.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 4, pp. 475–496, 1 pl., 9 figs., 1 graph, 1937 (issued April, 1938).

In October, 1937, the author received from the vicinity of Rome a few locally grown cotton bolls the carpels of which were withered and contained a mass of black, mummified fibres. A species of *Alternaria* was present on and in the fibres, with conidia arranged in chains of 4 to 5 or more; the conidia had a hyaline beak, 1 to 7 transverse and occasional oblique and longitudinal septa, and were more or less markedly constricted at the septa. They measured 14 to 66μ long (including a beak of 3 to 47μ and a length of 11 to 44μ excluding the beak) and 7 to 16μ broad. In culture the fungus formed woolly colonies with a slight, white efflorescence and the corresponding measurements for the conidia from month-old cultures were 16 to 114μ (2 to 76μ and 10 to 70μ) and 6 to 14μ. On the outside of the withered carpels was found another *Alternaria* with very few, darker, smaller conidia with shorter beaks. Cultures from the surface of the carpels gave carbonaceous colonies with a very short aerial mycelium; in month-old cultures the conidial measurements were 11 to 56μ long (2 to 24μ and 7 to 44μ) and 6 to 13μ broad.

In discussing the systematic position of the species of *Alternaria* reported as causing cotton leaf spot, the author points out that Hopkins provisionally referred his organism observed in Rhodesia to *A. gossypina* (Thüm.) [*R.A.M.*, xi, pp. 371, 638] on the assumption that Thümen's measurement for the length of the conidia did not include the beak, an assumption with which the author does not agree. Hopkins's fungus appears to him to be near to *A. macrospora* [ibid., viii, p. 171; xi, p. 638], in which the beak averages the same length as the conidium itself. In his opinion, all the *Alternaria* forms (including Hopkins's) reported as causing cotton leaf spot belong to one species or group, which can be referred to *A. macrospora* by reason of the identity of the host, the etiology of the disease, and the characters of the fungus.

The fungus found by the author in the bolls is referred to *A. macrospora*. That present on the carpels may possibly be *A. gossypina*, the characteristics on which this opinion is based being mainly the shortness of the beak, the very slightly marked constrictions, their number, and the dimensions of the conidia; in addition, the author's fungus appears to be saprophytic.

LEPESME (P.). **Recherches sur une aspergillose des Acridiens.** [Studies on an aspergillosis of Acridians.]—*Bull. Soc. Hist. nat. Afr. N.*, xxix, 5, pp. 372–381, 2 pl., 2 figs., 1938.

Further studies on the locust (*Schistocerca gregaria* and *Locusta migratoria*) disease recently reported from the Central Laboratory of Locust Biology, Natural History Museum, Algiers, as associated with *Bacillus prodigiosus* [*Bacterium prodigiosum: R.A.M.*, xvii, p. 173] denote that the primary cause of the epidemic is a fungus, *Aspergillus flavus* [ibid., xi, p. 696], the agent of stone brood of bees [ibid., viii, p. 105; ix, pp. 524, 591; xvi, p. 673], and a cause of infection of *Pseudococcus sacchari* in Egypt [ibid., xiii, p. 94], of *Pyrausta nubilalis* [ibid., xiii, p. 574], and of silk-worms [ibid., viii, p. 105].

The affected insects bore extensive ochraceous patches on the sternum and thoracic cavities and developed progressive muscular paralysis ending in sudden death, 24 hours after which the white, later greenish-olive conidiophores of the fungus spread over the entire body. Under natural conditions infection invariably occurs through the wing muscles, near a thoracic stigma, and in inoculation experiments this was also the most favourable channel for the entry of the fungus, abdominal infections being much more difficult to secure, while all attempts to introduce the organism through the tegument or buccal cavity gave negative results. The epidemic development of *A. flavus* on locusts is favoured by high temperatures (30° to 45° C.) and moderate to high humidity, and may be prevented by adjusting these factors within appropriate limits.

JANISCH (E.). **Eine neue Pilzkrankheit bei Nonnenraupen.** [A new fungous disease of Nun Moth larvae.]—*Arb. phys. angew. Ent.*, v, 1, pp. 1–20, 5 figs., 4 graphs, 1938.

Nun moth [*Lymantria monacha*] larvae in a 91-year-old pine stand interspersed with old beeches near Berlin were attacked in March, 1937, by a virulent epidemic due to *Aspergillus versicolor* [*R.A.M.*, xiv, p. 585] hitherto known only as a saprophyte and not previously recorded on *L. monacha*. The pathogenicity of the fungus was established by laboratory and field inoculation experiments, the optimum temperature and relative humidity for infection being about 22° C. and 90 per cent., respectively. Insects fed on oak leaves succumbed more readily to the disease than those given pine needles. External symptoms of infection include crippling of the prolegs and sternum, especially after a moult. The fungus was also pathogenic to silkworms [*Bombyx mori*], the pine Noctuid [*Panolis flammea*], and the pine Geometrid [*Bupalus piniarius*].

LODDER (J[ACOMINA]). **Torulopsis or Cryptococcus?**—*Mycopathologia*, i, 1, pp. 62–67, 1938.

At a meeting between the representatives of the American Committee

on Taxonomy and Nomenclature and the staff of the Yeast Division of the Centraalbureau voor Schimmelcultures on 23rd July, 1936, at Baarn, Holland, the author presented detailed evidence which led the members present to conclude that the use of the generic name *Cryptococcus* Kützing should be avoided in yeast taxonomy [cf. *R.A.M.*, viii, p. 677] as it is both a 'nomen dubium' and a 'nomen confusum', the former because doubt exists whether the first species of *Cryptococcus* described by Kützing, *C. mollis*, actually was a yeast, Kützing himself classifying the genus among the algae, and the latter because examination of authentic herbarium material of *C. mollis* showed it to consist of a mixture of at least five organisms.

On the other hand, it was agreed that while there were several arguments in favour of the generic name *Torulopsis* Berlese, as a valid name for a group of asporogenous yeasts, further information was required regarding Berlese's original diagnosis, since the first species described by him, *T. rosae*, apparently referred to a red yeast, probably belonging to *Rhodotorula* Harrison. A subsequent study of Berlese's diagnosis, however, has shown that he purposely included in his diagnosis the yeasts at that time referred to the genus *Torula* sensu Pasteur-Hansen. Furthermore, the diagnosis of *T. rosea* shows that it was a yeast with a strong fermentative power, and since the carotin red yeasts never cause fermentation it cannot belong to *Rhodotorula*. All the available evidence favours the opinion that Berlese's species was identical with *Torulopsis pulcherrima* (Lindner) Sacc. The author submits that the validity of the generic name *Torulopsis* for the asporogenous, non-mycelium-forming, colourless yeasts may now be considered as proved and suggests that the genus *Torulopsis* Berlese may be defined as cells round, oval, or rarely oblong, reproduced by much lateral budding, without the formation of pseudomycelium, true mycelium, ascospores, or carotin pigments.

DON (PHYLLIS A.). **Moniliasis.**—*S. Afr. med. J.*, xii, 2, pp. 49–51, 1938.

This is a clear survey of some important aspects of the knowledge at present available concerning the classification and morphology of the *Monilia* group of fungi, and their etiological relationship to various pathological conditions of man. The current tendency is to classify the pathogenic members of the group as *M.* [*Candida*] *albicans* [see next abstracts] or a variant of this species, and the non-pathogenic as *M. candida* [*C. vulgaris*: *R.A.M.*, xvii, p. 527]. In connexion with the potential implication of *C. albicans* in the various diseases under discussion it is mentioned that 18 per cent. of normal persons harbour the organism in the mouth or intestinal tract and may consequently act as unsuspected carriers.

BESTA (B.). **Il fenomeno della dissociazione in uno stipite di 'Mycotorula albicans'.** [The phenomenon of dissociation in a strain of *Mycotorula albicans*.]—*Mycopathologia*, i, 1, pp. 41–52, 2 pl., 1938. [English summary.]

From a strain of *Mycotorula* [*Candida*] *albicans* [see preceding and next abstracts] obtained from the sputum of a patient affected with a non-tubercular lesion of the lung and which gave colonies of the

normal S type, the author obtained a rough, verrucose colony allied to Arkwright's R phase. A comparative study of the micro- and macro-morphological and biochemical characters [which are described] of the two strains indicated that so-called dissociation in this species is related to a moderate polymorphism and polymetry of the yeast cells.

ELOY (L.). **Mycose et phlegmon récidivant chez l'enfant après amygdal-ectomie (irradiations-guérison).** [Mycosis and relapsing phlegmon in a child following tonsillectomy cure (by irradiations).] *Monde méd.*, xlviii, 910, pp. 46–50, 1938.

Clinical details are given of a case of relapsing phlegmon in a twelve-year-old girl in Brussels associated with the presence in the tonsillar crypt of *Oidium* [*Candida*] *albicans* [*R.A.M.*, xvii, p. 527 and preceding and next abstracts]. A complete cure was effected by radiotherapy.

OWEN (CORA R.), ANDERSON (M. B.), & HENRICI (A. T.). **Allergy in Monilia and yeast infections.**—*Mycopathologia*, i, 1, pp. 10–25, 1938.

After a critical review of the literature on the occurrence of allergic reactions to yeasts and *Monilia* species the authors describe in detail three series of experiments made on laboratory animals to ascertain the part played by allergy in the development of mycoses caused by these organisms. The investigations consisted of sensitization experiments with *Monilia* [*Candida*] *albicans* and *Debaryomyces neoformans* [see preceding and next abstracts] and cross-sensitization experiments with various yeasts and strains of *C. albicans*. The following tentative conclusions are reached. Spontaneous infections with yeasts and species of *Monilia* may result in an allergic state manifested by generalized eruptions ('ids') and also by the results of skin tests; such an allergic state is generally harmful rather than beneficial and may even be fatal. Sensitization may in some cases be a pre-requisite for infection. Unequivocal results from skin tests can be obtained, apparently, only by inoculation of the living cells; the reacting substance appears to be closely bound to the cells, and is thermolabile. Sensitization is broadly specific, cross-reactions with sporotrichin and trichophytin being lacking. There is only very slight specificity within the yeast-*Candida* group, cross-reactions being common. The authors consider that their most important observation is that the ability of a strain to sensitize and elicit reactions is correlated with its potential virulence, even when the strain is not virulent for the test animal. Thus yeasts of human origin gave more sensitivity and stronger reactions in rabbits than did saprophytic yeasts. Strains of *Candida* pathogenic to rabbits gave more sensitivity and stronger reactions in rabbits than did strains not pathogenic to rabbits.

DUCUING (J.), BASSAL (L.), & MILETZKI (O.). **Tumeur osseuse de l'orbite à allure cancéreuse déterminée par le Torulopsis neoformans.** [A bony tumour of the orbit simulating cancer caused by *Torulopsis neoformans*.]—*Bull. Ass. franç. Cancer*, xxvi, 6, pp. 580–584, 2 figs., 1937.

The organism isolated from a tumour on the right orbital rim of a

75-year-old woman was identified by M. Langeron and P. Guérin, on the basis of its cultural and morphological characters, as *Torulopsis* [*Debaryomyces*] *neoformans* [see preceding and next abstracts].

FAWCITT (R.). **Occupational diseases of the lungs in agricultural workers.**—*Brit. J. Radiol.*, N.S., xi, 126, pp. 378–392, 13 figs., 1938.

Much of the subject matter of this paper on bronchomycoses of agricultural workers has been noticed from the author's previous work [*R.A.M.*, xvii, p. 529]. The following record may be mentioned: *Absidia corymbifera*, a fungus associated with the nasal mucous membrane of horses, pigs, and cattle, was isolated in one case from the sputum of a stableman.

BENEDEK (T.). **Further investigations on Bacillus endoparasiticus (morphology and systematic position of Schizosaccharomyces hominis Benedek, 1927, a constant endoparasite in Man).**—*Mycopathologia*, i, 1, pp. 26–39, 3 pl., 1938.

Further protracted investigations [which are described] on *Schizosaccharomyces hominis* [= *Mycoderma hominis* (Ben.) Vuill.: *R.A.M.*, xvii, p. 242] have convinced the author that the organism is a constant endoparasite in man, and have also shown that it is a spore-forming bacillus, for which reason the name *Bacillus endoparasiticus* is suggested for it.

MOORE (M.). **Cultivation of Malassezia furfur, etiological agent of pityriasis (tinea) versicolor.**—*Mycopathologia*, i, 1, pp. 53–61, 8 pl., 1938.

In the stratum corneum of early lesions of pityriasis versicolor the causal fungus (*Malassezia furfur*) [*R.A.M.*, xvii, p. 599] shows a fine, filamentous, branching mycelium $1\frac{1}{2}$ to 2μ in diameter. As the lesions become older the organism develops cross walls, forming short hyphal cells measuring approximately 10 to 16 by $1\frac{1}{2}$ to 4μ, which produce arthrospore-like cells; these become spherical, and then free, measure approximately 3 to 6 (occasionally 8)μ in diameter, and form the clusters found in old lesions.

On two occasions the author succeeded in culturing *M. furfur* from infected scales in a solution of peptone (1 per cent.) and maltose (4 per cent.) incubated at 37° C. Subcultures on agar media varied from flat and dull, moist and shiny or mucoid and stringy, punctate, vermiform, cerebriform, to rugose, crateriform, verrucose, vermiculate, and somewhat velvety; some showed small blebs, and wort agar produced an arborescent type of growth. All the characteristics seen in the natural host were observed microscopically in the cultures (including the formation of spherical, thick-walled, arthrospore-like cells up to 10μ in diameter), except that the fungus elements in the cultures were larger. On various media, which became dark with age, the fungus produced a creamy-buff, dull grey to ochraceous-buff and dark cinnamon pigmentation resembling that seen in lesions. The biochemical reactions included liquefaction of gelatine in 5 days, starting at the surface, acidification of litmus milk after 10 days, with no curdling, production of acid without gas from dextrose, d-xylose, amygdalin, and d-levulose, and no

acid or gas production from maltose, lactose, saccharose, d-galactose, rhamnose, raffinose, dextrin, d-mannitol, l-arabinose, and starch.

Intracutaneous and intratesticular inoculations on rabbits and guinea-pigs produced granulomatous lesions which were heavily infiltrated, erythematous, hard, and persistent. Human inoculations gave positive results in 3 out of 8 cases. The fungus is temporarily placed in the Eremascacaceae Imperfectae as a distinct genus with *M. furfur* as the type species.

Godal (J.). **Un cas d'épidermophytie généralisée à Trichophyton rubrum.** [A case of generalized epidermophytosis due to *Trichophyton rubrum*.]—*Bull. Soc. Path. exot.*, xxxi, 5, pp. 337–339, 1938.

Clinical details are given of a case of generalized epidermophytosis due to *Trichophyton rubrum* [*R.A.M.*, xvii, p. 599] investigated at the Maritime Hospital, Rochefort, France. The patient had been on military service in Indo-China, where the disease was presumably contracted, the causal organism being of rare occurrence in France.

Lewis (G. M.), Montgomery (R. M.), & Hopper (Mary E.). **Cutaneous manifestations of Trichophyton purpureum.**—*Arch. Derm. Syph., Chicago*, xxxvii, 5, pp. 823–839, 8 figs., 1938.

Trichophyton purpureum [*R.A.M.*, xvii, p. 321] was isolated from 100 cases (63 males and 37 females) of fungus infection involving various parts of the body. There is some reason to believe that this organism is becoming more prevalent in New York than formerly. Three of the cases (all adult males) are described in detail. The various clinical manifestations of the fungus may simulate psoriasis, arsenical keratosis, neurodermatitis, eczema, sycosis vulgaris, and erythema annulare centrifugum (Darier). Two rare instances are recorded, one of infection of all the nails of the hands and feet and one of follicular involvement. The reaction to trichophytin of patients infected by *T. purpureum* is slightly positive or negative. The histologic picture is consistently that of a simple inflammatory process, but the lesions caused by the fungus are very refractory to therapeutic treatment.

Catanei (A.). **Sur les rapports entre les caractères des cultures des Trichophyton violaceum et glabrum et leur pouvoir pathogène pour les animaux.** [On the relations between the cultural characters of *Trichophyton violaceum* and *glabrum* and their pathogenicity to animals.]—*C.R. Soc. Biol., Paris*, cxxviii, 17, pp. 255–256, 1938.

Guinea-pigs inoculated at the Pasteur Institute of Algeria with rice agar cultures of *Trichophyton violaceum* and *T. glabrum* bearing conidia [*R.A.M.*, xvii, p. 38] responded much more readily to infection than those treated with cultures of the same fungi from Sabouraud's medium on which no fructifications develop. Retrocultures were obtained in all cases. The pathogenicity of these species is thus evidently enhanced by cultivation on a substratum stimulating reproductive activity.

Pignot (M.), Rabut (R.), & Rivalier (E.). **La teigne à l'École Lailler de 1930 à 1937.** [Ringworm at the 'École Lailler' from 1930 to 1937.]—*Pr. méd.*, xlvi, 19, pp. 345–347, 1938.

During the period from 1930 to 1937, 1,117 children were treated

for ringworm at the 'École Lailler' (the dermatological department of the Saint-Louis Hospital, Paris), and of these 1,061 yielded material for microscopic examination. The disorders investigated were distributed as follows: 542 cases of microsporosis (75 per cent. *Microsporon audouini* [*R.A.M.*, xvii, pp. 174, 244, 599], 25 per cent. *M. lanosum* [ibid., xvii, p. 599], 306 of trichophytosis (53 per cent. *Trichophyton crateriforme* [ibid., xvi, pp. 179, 535], 22 per cent. *T. acuminatum* [ibid., xvi, p. 317], and 25 per cent. *T. violaceum* [see preceding abstract]), 186 of favus [?*Achorion* spp.], 25 of animal ringworms and 2 of mixed origin. Details are given of the methods of detection and diagnosis employed, inoculation and injection experiments, and therapeutic technique, mostly by irradiation.

Milochevitch (S.) & Ekersdorf (V.). **Lésions pilaires dans les teignes expérimentales produites par les cultures pléomorphiques des dermatophytes.** [Pilary lesions in the ringworms experimentally induced by pleomorphic cultures of dermatophytes.]—*C.R. Soc. Biol., Paris*, cxxvii, 13, pp. 1369–1371, 1938.

Only four of the eight dermatophytes used in experiments on guinea-pigs at the Central Institute of Hygiene, Belgrade, to determine the pathogenicity of pleomorphic cultures gave positive results, viz., *Sabouraudites felineus* [*Microsporon felineum*], *S. lanosus* [*M. lanosum*], *Ctenomyces* [*Trichophyton*] *mentagrophytes*, and *C.* [*T.*] *radiolatus*, and the degree of parasitization was very restricted. Only a very few hairs were involved, and in some cases infection was limited to the epidermis. It is evident from these observations that the infectivity of pleomorphic cultures tends steadily to diminish and is ultimately lost.

Adams (J.) & Parfitt (E. H.). **Studies on the mold mycelia of sour cream butter.**—Abs. in *J. Dairy Sci.*, xxi, 5, pp. 147–148, 1938.

Commercial samples of butter manufactured between 1st August and 1st April were examined for the presence of [unspecified] mould mycelia with the aid of Wildman's technique [*R.A.M.*, xvi, p. 536] at Purdue University, Indiana. The mycelial content of the butter showed a definite seasonal trend, being highest during the summer and lowest in the winter months. Of 205 samples taken during December and January, 99 per cent. of the 103 first-grade and 41 per cent. of the 102 second-grade samples yielded mycelial counts of less than 40 per cent. positive fields. The retention of mould mycelia in butter was found to range from 30 to 60 per cent. of the total mould content of the cream. The mould mycelial count of the butter was found to be influenced by various factors affecting the contamination of the cream, e.g., age, incubation temperature, amount of cream surface exposed to air, and agitation of cream during holding.

Shadwick (G. W.). **A study of comparative methods and media used in microbiological examination of creamery butter. I. Yeast and mold counts.**—*Food Res.*, iii, 3, pp. 287–298, 1938.

Full details are given of studies at the Beatrice Creamery Company,

Chicago, on comparative methods for determining the yeast and mould counts of salted and unsalted butters [see preceding abstract].

TASUGI (H.) & KUMAZAWA (M.). **Phytophthora rot of Lily.**—*J. imp. agric. Exp. Sta.*, iii, 2, pp. 207–238, 3 pl., 3 graphs, 1938. [Japanese, with English summary.]

A specimen of *Lilium auratum* suffering from a greyish-brown blight of the leaves, stems, flowers, and bulbs in the Saitama Prefecture, Japan, in 1934, yielded a species of *Phytophthora* which the authors compared with three other isolates of this genus obtained from *L. elegans*, *L. longiflorum*, and *L. dahuricum* in different parts of the country. Of the four organisms, the two from *L. elegans* and *L. longiflorum* were identified as *P. parasitica* and the other two (from *L. dahuricum* and the specimen of *L. auratum* under observation) as *P. cactorum* [*R.A.M.*, xiv, pp. 147, 399]. Both strains of *P. parasitica* grew well on bean, potato, oatmeal, and maize meal agars, the first-named being the most suitable, and developed throughout a temperature range of about 4·5° to 35° C.; the optimum for the *L. elegans* strain was from 24° to 28° and for that from *L. longiflorum* just below 28°. Both strains flourished at P_H 5·1. The strain of *P. cactorum* isolated from *L. dahuricum* also made good growth on the above-mentioned media between 4·5° and 31°, with an optimum at 24°, the most favourable hydrogen-ion concentration being P_H 5·1 or slightly higher. The average oospore diameter of *P. parasitica* from *L. elegans* was found to be 20·5μ, the corresponding figures for *P. cactorum* from *L. dahuricum* and *L. auratum* being 23 and 23·6μ, respectively. In inoculation experiments on *L. longiflorum* and *L. elegans* the *P. parasitica* strains produced much more rapid and virulent rot than those of *P. cactorum*.

ROSEN (H. R.). **Arkansas disease-control work in 1937.**—*Amer. Rose Annu., 1938*, pp. 146–148, 1938.

Observations at the Arkansas Agricultural Experiment Station during 1936–7 showed that the mycelium of the fungus causing black spot of roses [*Diplocarpon rosae*: *R.A.M.*, xvii, p. 590 and next abstracts] persists through the winter in old leaves clinging to the bushes and produces a fresh crop of conidia to disseminate infection in the spring. Under local conditions the foliage is much more liable to attack than the stems. Kolotex [ibid., xiii, p. 528] gave very good results in the control both of black spot on hybrid tea roses and powdery mildew [*Sphaerotheca pannosa*] on climbers, but had to be discontinued in July on account of severe burning of the leaves. Hybrid tea roses showing an exceptional degree of resistance to *D. rosae* are Safrano, Duchesse de Brabant, Isabella Sprunt, Mlle Franziska Krüger, and Mrs. B. R. Cant. Such varieties respond very unfavourably to fungicidal treatment.

PAPE (H.). **Die wichtigsten Rosenkrankheiten und Rosenschädlinge und ihre Bekämpfung.** [The most important Rose diseases and Rose pests and their control.]—*Rosenjahrb., 1938*, 2, pp. 56–67, 1938.

This is a useful survey of the principal diseases and pests of roses in Germany, together with brief, practical directions for their control.

In order to guard against infection by *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xiv, p. 313] the roots should be dipped at transplanting in a loam emulsion containing a disinfectant solution, e.g., uspulun or ceresan (liquid), either of which may also be used to paint the graft union sites; two or four weeks before planting sulphur dust should be incorporated with the soil at the rate of 50 to 100 gm. per sq. m.

The bark spot disease due to *Coniothyrium wernsdorffiae* [ibid., xv, p. 22] may be combated by the excision of infected material, application of tree wax or carbolineum to the wounds, and repeated summer treatments with 1 per cent. Bordeaux mixture plus saponin or tezet 10 [ibid., xv, p. 508], followed by a pre-dormancy spray of 2 per cent. Bordeaux mixture, lime-sulphur (10 in 90), or milk of lime to the stems and branches after removal of all remnants of foliage. The susceptible Crimson Rambler should not be cultivated where this disease is to be feared.

Mildew (*Sphaerotheca pannosa*) [ibid., xv, p. 298 and next abstract] also occurs in a virulent form on Crimson Ramblers, which may be replaced by the relatively resistant American Pillar, Blush Rambler, Carmine Pillar, Lady Gay, Alberic Barbier, Excelsa, Eisenach, or Paul's Scarlet Climber. At the first signs of infection, applications of 'ventilated' sulphur, sulphur dust, lime-sulphur ($1\frac{1}{4}$ to 2 in 100), erysit [ibid., xvi, p. 322], or vomasol S [ibid., xv, p. 583] should be started and continued at 10- to 14-day intervals throughout the season. In the late autumn and early spring the bushes should be treated with lime-sulphur (10 in 90).

Autumn and spring treatment with lime-sulphur, 2 per cent. Bordeaux mixture, or 2 to 8 per cent. carbolineum is effective against rust (*Phragmidium mucronatum*) [ibid., xvii, p. 532]. Repeated summer treatments with 1 per cent. Bordeaux or Burgundy mixture or a recognized commercial preparation are recommended.

Black spot (*Diplocarpon rosae*) [see preceding and next abstracts] also yields to frequent spring and summer applications of 1 per cent. Bordeaux mixture, lime-sulphur, or sulphur dust, supplemented by dormant treatments of the bushes and underlying soil with 6 per cent. carbolineum and by stringent sanitation. Among the numerous varieties suffering comparatively little from black spot may be mentioned Königin Luise, Golden Ophelia, Betty Uprichard, Ami Quinard, Edith Nellie Perkins, Red Radiance, Crimson Glory, Mrs. Pierre S. du Pont, Pink China, *Rosa nitida*, *R. moyesii*, *R. hugonis*, and *R. nuttaliana*.

Repeated applications of an approved fungicide are advocated for the control of downy mildew (*Peronospora sparsa*) [ibid., xiv, p. 313]. Strict attention to sanitation of the beds and houses, provision of ample ventilation, avoidance of extreme humidity, and other cultural measures will help to eliminate both this disease and grey mould (*Botrytis cinerea*) [loc. cit. and ibid., xiv, p. 363].

Suit (R. F.). **Red copper oxide up to date.**—*Amer. Rose Annu., 1938*, pp. 153–157, 1938.

The best control of black spot [*Diplocarpon rosae*] on hybrid tea roses [see preceding abstracts] in a comparative experiment with various fungicides at Clifton Springs, New York, in 1937 was obtained with

sulphur dust 90–10, which reduced the proportion of moderately and severely diseased plants from 89·1 to 9·1 per cent. Red copper oxide, cupro-K [*R.A.M.*, xvii, p. 608], and cuprocide 54 at 0·44 oz. plus $\frac{1}{8}$ per cent. soluble cottonseed oil came next in efficacy. Sulphur dust and red copper oxide also gave the best control of mildew [*Sphaerotheca pannosa*: ibid., xvii, p. 585], while cuprocide 54, tri-ogen, and Cupro-K were fairly satisfactory in this respect. Detailed directions for the application of the various materials are given.

RATSEK (J. C.). **The probable effect of peduncle abscission on the incidence of 'die-back' of Roses.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 788–794, 1 fig., 1938.

Certain varieties of field-grown rose bushes in eastern Texas are affected by a die-back chiefly due, according to Taubenhaus and Boyd (*Rep. Tex. agric. Exp. Sta.*, pp. 19–21, 1935), to a species of *Diplodia* [*R.A.M.*, xvii, p. 590]. The condition is characterized by a blackening of the peduncle after the bloom shatters, the necrosis spreading down the peduncle and sometimes entering the rose cane. If abscission of the peduncle occurs before the fungus enters the main cane no damage is done, but if the cane is invaded, the necrotic area descends, and the whole branch may succumb. The dead tissue later turns silvery-grey or light tan, and black spore masses are visible to the naked eye. Hybrid tea roses with Pernetiana 'blood' are highly susceptible. The condition is most serious after protracted wet periods. One-year forced budded plants are only slightly susceptible, though two-year budded plants of the same variety are frequently killed. High nitrate applications after hard pruning, especially when accompanied by high soil moisture and desiccation at harvest time and afterwards, greatly increase incidence. It appears that naturally weak varieties, particularly when in a weakened condition, are most susceptible to attack.

Experimental data are given showing that defoliation increased die-back (from 8·99 per cent. in the controls to 78·54 per cent. when all the leaves were removed) and that disbudding slightly decreased it. Factors tending to provide a rapid supply of food to the abscission layer increase the rapidity of abscission, and cultural methods that will increase the supply of available food reduce the incidence of the disease.

JENKINS (ANNA E.) & MASSEY (L. M.). **Rose anthracnose.**—*Amer. Rose Annu., 1938*, pp. 136–141, 2 pl., 1 fig., 1 map, 1938.

The available information on the distribution, history, life-cycle, symptomatology, and control of rose anthracnose (*Sphaceloma rosarum*) is summarized, with special reference to United States conditions [*R.A.M.*, xvii, p. 325 and next abstract].

JENKINS (ANNA E.) & MCWHORTER (F. P.). **Additional records of Rose anthracnose in the United States.**—*Phytopathology*, xxviii, 5, pp. 360–363, 1 fig., 1938.

Further details are given concerning the distribution of rose anthracnose (*Sphaceloma rosarum*) in North Carolina, Oregon, Michigan, and Tennessee [see preceding abstract].

McWhorter (F. P.). **Narcissus mosaic and early maturity.**—*Plant Dis. Reptr*, xxii, 9, pp. 147–148, 1938. [Mimeographed.]

During recent years the mosaic content of the better narcissus [*R.A.M.*, xvii, p. 604] varieties in the average plantings found in the north-western parts of the United States has been reduced to between 0 and 2 per cent. Meantime, however, another condition has developed that leads to early maturity, with resulting degenerative effect. The affected plants show various striking symptoms, such as purple or white streaking, or breakdown of the terminal areas of the leaves into 'paper tips'. In the past five years the incidence of this condition has risen from a trace to 7 per cent. The attacked plants become conspicuous immediately after flowering, and may mature 30 to 60 days before the normal time. The most virulent form of the trouble yet noted by the author was in a consignment of the King Alfred [daffodil] variety received from Holland in 1937. The cause remains at present obscure. Observations on over 2,000 individuals demonstrated that it becomes fixed within clone units; immediate control may therefore be effected by roguing.

Pirone (P. P.). **Geranium crinkle in New Jersey.**—*Plant Dis. Reptr*, xxii, 9, p. 146, 1938. [Mimeographed.]

Crinkle disease [*R.A.M.*, xvii, p. 506] was observed recently for the first time on *Pelargonium zonale* plants in New Jersey, where in one greenhouse over 400 plants showed the characteristic irregular to circular chlorotic areas $\frac{1}{2}$ to 2 mm. in diameter on ruffled, dwarfed young leaves. On old leaves the spots were generally circular, 2 to 5 mm. in diameter, and often showed two concentric rings. The condition closely resembles curly leaf, as described by Pape [ibid., vi, p. 728; see also next abstract]. According to the grower, the disease has appeared since 1933 on the Helen Michell, Ricard, and Olympic Red varieties; the Improved Ricard and Poitevine varieties appear to be less susceptible, and the white varieties seem to be immune. The symptoms, which are masked in summer, are most conspicuous in March and April. Cuttings taken early in February may appear to be normal, no symptoms appearing until the plants are 6 to 8 weeks old. It is assumed that much of the disease was probably transmitted through the cuttings, as the symptoms were masked when these were made.

Berkeley (G. H.). **Leaf curl of Geranium.**—*Canad. Hort.*, lxi, 4, p. 108, 1 fig., 1938.

In connexion with a case of leaf curl of the Helen Michell geranium [*Pelargonium zonale*: *R.A.M.*, xv, p. 444, and cf. preceding abstract] at St. Catharines, Ontario, in 1937, experiments were conducted which demonstrated the transmissibility of the disease from infected to healthy plants by means of grafting, the incubation period lasting about six months. Circumstantial evidence further indicates that whiteflies [Aleyrodidae] are concerned in the transmission of the disease, while suspicion also falls on *Macrosiphum pelargonii*.

Berkeley (G. H.). **Dahlia mosaic and its control.**—*Canad. Hort.*, lxi, 5, pp. 146–147, 5 figs., 1938.

The symptoms of dahlia mosaic [*R.A.M.*, xiv, p. 634] on such tolerant

varieties as Mrs. I. de Ver Warnar, Jane Cowl, Catharine Unwin, and Nettie Learmonth may be negligible in Ontario, where only one out of ten large gardens visited in 1937 was free from the disease, whereas the susceptible Croydon Beauty, Treasure Island, Frontenac, Goodnight, Countess of Lonsdale, and Ambassador respond to infection by severe stunting. Observations on 212 plants of over 50 varieties show that the symptoms may or may not persist throughout the season, but in any case they invariably reappear ultimately. Good control has been obtained by thorough roguing; in 1936 all diseased plants were dug out of a large planting at St. Catharines with 70 per cent. mosaic at the end of the season, thereby reducing the incidence of infection to 15 per cent. in the following year. Dahlia mosaic being spread by the peach aphid [*Myzus persicae*], new varieties or 'doubtful' stock should be segregated for at least a year. Ordinary stock purchased from commercial growers falls in the 'doubtful' category, only 22 out of 47 varieties purchased from such sources having been found healthy in 1937.

PRESTON (N. C.). **Successful control of Michaelmas Daisy wilt.**—*Gdnrs' Chron.*, ciii, 2681, p. 338, 2 figs. (1 on p. 339), 1938.

W. J. Dowson's recommendation for the control of Michaelmas daisy wilt (*Verticillium vilmorinii*) [*R.A.M.*, xi, p. 623] by striking cuttings from the tops of the newly formed shoots [ibid., iii, p. 39] does not seem to have been generally followed, but the writer has obtained very satisfactory results from this simple method. In 1932, 90·9 per cent. of the plants arising from 45 cuttings taken in this way from severely diseased stocks of the Queen Mary and Brightest and Best varieties in a Staffordshire nursery were free from disease, and a certain proportion of the sound material was returned to the grower to form the nucleus of a fresh stock. By the prompt removal of the few individuals since contracting the wilt from extraneous sources it has been possible to maintain beds of each variety in a clean and flourishing condition.

FOSTER (W. R.). **Control of Snapdragon rust (Puccinia antirrhini D. & W.).**—*Sci. Agric.*, xviii, 9, pp. 524–526, 1 pl., 1938.

The results of experiments in 1936 and 1937 at Victoria, British Columbia, showed that copper sprays were more effective than sulphur in the control of snapdragon [*Antirrhinum majus*] rust (*Puccinia antirrhini*) [*R.A.M.*, xvii, pp. 589, 602] in the coastal areas of the Dominion. Two applications of 4-4-40 Bordeaux mixture plus a spreader (1 lb. agral 2, 1 pt. lethalate [ibid., xvi, p. 797], or 2 qts. penetrol [loc. cit.] per 100 gals. spray) before the flowers began to open were sufficient to prevent the development of the rust on snapdragons grown for seed without any necessity for further applications. The protection from rust afforded to the seed crop by bouisol (1 pt. to 10 gals. water), bordinette (1 lb. to 10 gals.), copper hydro [ibid., xvii, p. 608] (1 lb. to 10 gals.), and 4-5-40 Burgundy mixture, with the addition to each of 1 lb. agral 2 per 100 gals. spray, was sufficient to warrant their trial on ornamental plants. The late appearance of the rust from 1934 to 1937 may be partly explained by the burning of volunteer and other snapdragon plants before spring.

England and Wales : new and interesting phytopathological records for the year 1937.—*Int. Bull. Pl. Prot.*, xii, 5, p. 97, 1938.

A severe outbreak of downy mildew (*Peronospora antirrhini*) [*R.A.M.*, xvii, pp. 43, 532] was observed among some 8,000 seedlings of the cultivated *Antirrhinum majus* in a nursery near Brighton. Those seedlings still in boxes were burnt immediately, together with the boxes and soil, and an attempt was made to remove and destroy those already planted out. The disease did not spread noticeably, and no other authentic outbreak has been reported in the country. *P. antirrhini* is stated to occur on the wild *A. orontium* in Europe.

Wenzl (H.). **Botrytis cinerea als Erreger einer Fleckenkrankheit der 'Cyclamen'-Blüten.** [*Botrytis cinerea* as the agent of a spot disease of *Cyclamen* flowers.]—*Phytopath. Z.*, xi, 1, pp. 107–108, 1938.

Cyclamen flowers were severely attacked in Austria in the exceptionally wet and cold late summer and autumn of 1937 by *Botrytis cinerea* [*R.A.M.*, vi, p. 164], which caused an unsightly spotting—dirty greyish-brown on white and pale pink varieties, water-soaked and discoloured on deep red ones, the lesions attaining a diameter of 2 to 3 mm.

Raabe (A.). **Ceratophorum setosum Kirchn. als Ursache eines Sämlingsterbens bei Ginster.** [*Ceratophorum setosum* Kirchn. as the cause of a dying-off of Broom seedlings.]—*Z. PflKrankh.*, xlviii, 5, pp. 231–232, 1 fig., 1938.

Ceratophorum setosum was isolated in July, 1937, from broom (*Sarothamnus* [*Cytisus*] *scoparius*) seedlings showing an extensive dark spotting of the leaves and stems [cf. *R.A.M.*, vii, p. 583] at three nursery-gardens in the Tübingen district of Germany. The disease assumed a virulent character, destroying the plants over an area of 1 are in a few days, and breaking out again in September after a pause in August. At the same time, white lupins (*Lupinus albus*) in the vicinity of Berlin and east Germany were severely attacked by the same fungus [ibid., xvi, p. 655].

Jenkins (Anna E.). **New records of anthracnose of Labrador Tea (Elsinoe ledi) and of Snowberry (Sphaceloma symphoricarpi).**—*Phytopathology*, xxviii, 5, pp. 374–375, 1 fig., 1938.

Further specimens of *Elsinoe ledi* on Labrador tea (*Ledum glandulosum*) have been collected in California and of *Sphaceloma symphoricarpi* on snowberry (*Symphoricarpus* sp.) in Oregon and New York State [*R.A.M.*, xii, p. 661].

Scupin (L.). **Ein Beitrag zur Ozonfrage.** [A contribution to the ozone question.]—*Obst- u. Gemüseb.*, lxxxiv, 5, pp. 67–68, 2 figs., 1938.

The use of ozone as a preventive of fungal and bacterial rots of foodstuffs (especially fruit and vegetables) in cold storage [*R.A.M.*, xvii, p. 613] is stated to be giving very satisfactory results in Germany, while H. Kessler reports favourably on its efficacy in the control of decay in five out of seven apple varieties in Switzerland, the loss among Ontario apples, for instance, being reduced from 30 to 13 per cent.;

the condition of stored cherries was also improved by the gas. Particulars have been published (*Z. ges. Kälteindustr.*, 6, 1934) of experiments carried out by the writer and A. Heiling at the Vegetable and Fruit Storage Research Station, Kalbe (Germany), concerning the action of ozone on the growth and sporulation in the atmosphere of the ubiquitous *Penicillium glaucum*, which was inhibited to an average extent of 63 per cent. by the treatment. No adverse effects in the form of undue acceleration of maturity of fruit through ozonization have been observed.

Since the free oxygen atom of ozone rapidly combines with other substances, fresh supplies of the gas must be introduced into the storage room at frequent intervals; in practice it is commonly put into operation two or three times daily for periods of half an hour to an hour, the quantities liberated being measured by iodometric or colorimetric methods or by means of a gasometer.

MITTMANN (GERTRUD). **Infektionsversuche an Obstbäumen mit Stämmen verschiedener Herkunft von Monilia cinerea und Monilia fructigena.** [Inoculation experiments on fruit trees with strains of various origin of *Monilia cinerea* and *Monilia fructigena*.]—*Z. PflKrankh.*, xlviii, 5, pp. 232–246, 9 figs., 1938.

Young trees of different varieties of sweet and sour cherry, peach, pear, and apple were subjected to blossom and twig inoculations with 23 strains of diverse origin of *Monilia cinerea* [*Sclerotinia laxa*: *R.A.M.*, xvii, p. 536] and *M.* [*S.*] *fructigena*. Successful results were obtained with conidia both from naturally occurring 'cushions' and from malt agar cultures, but not with the microconidia developing profusely in the latter.

The highest incidence of infection on cherry blossoms was secured with three strains of *S. laxa* from sour cherry, shade Morello, and plum, respectively, and one of *S. fructigena* from apple. The sour cherry strain of *S. laxa* also infected peach blossoms (10 positive results out of 29), while that from shade Morello attacked an early plum in one test out of seven, and the Le Lectier pear in two out of six. The twig series of inoculations were effective only in the case of *S. laxa* on cherries, and preliminary wounding was essential to secure the entry of the fungus. A flow of gum was exuded from the site of invasion, the portion above which withered and died. Twig inoculations with *S. fructigena* gave uniformly negative results.

VYUNOFF (S. F.), FRIEDRICHSOHN (G. A.), & VERTOGRADOVA (Mme O. N.). Болезни плодовых растений (хлороз и черный рак) [Fruit crop diseases (chlorosis and black canker).]—87 pp., 9 figs., 1 diag., Саратов. плодоягод. опыт. Ст. [Saratoff Fruit Exp. Sta.], 1938.

The first part of this book (pp. 3–56) comprises an account by S. F. Vyunoff of his studies on the lime-induced chlorosis [*R.A.M.*, ix, p. 43; x, p. 676; xvii, p. 472] of apple, plum, raspberry, *Acer tartaricum*, *Syringa vulgaris*, and *Caragana arborescens* in the Saratoff Region of the U.S.S.R. The disease affects fruit trees mainly in the south and south-east of the Union and is attributed to insufficient intake of iron. Control measures

recommended are the introduction of iron salts and sulphuric acid into the soil, the planting of resistant varieties, and the avoidance of alkaline fertilizers. *Convolvulus arvensis* can be used as an indicator plant.

In the second part (pp. 57–86) G. A. Friedrichsohn and Mme O. N. Vertogradova describe the results of their field and laboratory investigations on the black canker of apple and pear, caused by *Sphaeropsis malorum* Peck [*Physalospora obtusa*: ibid., xvii, p. 46]. The disease occurs in the Saratoff Region on both old and young trees in the form of a leaf spot, fruit rot, and bark necrosis. The last-named is the most prevalent and harmful form, attacking weak trees intensively, and developing mostly through wounds, especially cracking of the bark on the south and south-west side of the trees. On rare occasions bark necrosis was caused by *Coniothyrium piricola* [*C. tirolense*: ibid., xvii, p. 187], while *Cytospora capitata* [ibid., xi, p. 745], *Phoma* [*Ascochyta*] *pirina* [ibid., xvi, p. 106], and *Schizophyllum alneum* [*S. commune*: ibid., xvii, p. 46] were sometimes present as secondary invaders. The main period of infection by *Physalospora obtusa* extended from the beginning of spring to the end of autumn, and the incubation period varied between 15 and 21 days from April to mid-August and between 25 and 27 days from mid-August to October. Resistance tests showed that although the local varieties of apples varied in their susceptibility to the disease, none of them was entirely resistant. Watering the orchards at a rate of 400 cu. m. per hect., repeated three times, arrested the development of the infection. Satisfactory control was obtained by scraping the wounds, disinfecting them with 5 per cent. iron sulphate, 1 per cent. copper sulphate, or 3 per cent. sodium fluoride, and subsequently applying an oil paint, and by spraying with Bordeaux mixture in summer or with iron sulphate (6 or 8 per cent.) in early spring or late autumn.

Wormald (H.) & Harris (R. V.). **Notes on plant diseases in 1937.**—*Rep. E. Malling Res. Sta., 1937*, pp. 181–186, 1938.

These notes on plant diseases investigated at East Malling in 1937 [*R.A.M.*, xvi, p. 756] contain the following items of interest. A disease seen on Newton Wonder apples received from Buckinghamshire, characterized by irregular sunken areas, dark green blotched with brown, confined to the eye end of the fruit, and more conspicuous than ordinary bitter pit, was identified by H. Hill as blotchy pit. A disease thought to be a form of bitter pit occurred on pears, which showed a deeper pitting than apples and were often deeply dimpled and very irregular in shape. Many of the raspberry canes on the plantations of the Lloyd George variety at the Research Station exhibited during the early spring severe symptoms of 'dwarf-lateral scorch', but recovered later on and yielded a heavy crop. In similar cases observed on heavier soils of the Kentish Weald the subnormal development of laterals persisted and the crop was adversely affected. A relatively high mean temperature during the dormant period was experimentally shown to be a primary cause of the disease, but the observed natural recovery indicates that other factors are involved as well. Leaf blotch was unusually prevalent on hawthorn [*Crataegus oxyacantha*] in 1937, the causal fungus, *Sclerotinia cydoniae* [cf. ibid., xii, p. 488], being so far as is known confined to this host,

though the quince and the medlar have each a leaf-blotch fungus. *Verticillium dahliae* was found to produce a wilt of the Huxley's Giant and the Royal Sovereign varieties of strawberries [cf. ibid., xiii, p. 454], causing the outer and older leaves of well-grown plants to wilt and die shortly before cropping, while the petioles of the wilting leaves, the fruit stalks, and pedicels showed blue-black streaks and had a stringy and twisted appearance owing to the collapse of the cortical tissues. *Botrytis cinerea* was the chief fungal disease of strawberries during the year [ibid., xvi, p. 692]. *Stereum purpureum* was present on dead portions of walnut branches which had been cut back.

MOORE (M. H.). **Field trials in 1937 of the fungicidal and phytocidal properties of certain sprays used against Apple scab. A progress report.**—*Rep. E. Malling Res. Sta., 1937*, pp. 229–235, 2 figs., 1938.

In spraying tests against *Venturia inaequalis* on apple [*R.A.M.*, xvii, p. 405] carried out in 1937 on 10-year-old bush trees of Worcester Pearmain, Allington Pippin, and Newton Wonder various weak sprays containing sulphur or copper were applied twice before and twice after blossom. Lime-sulphur, used at 1 per cent. by volume, gave good control of scab, causing slight leaf- and fruit-drop only in Newton Wonder. The application of lime-sulphur (1 per cent.) pre-blossom followed by sulsol (0·5 per cent. by weight) or tetramethylthiuram disulphide [loc. cit.] (0·02 per cent. by weight) post-blossom showed distinct promise, but the use of lime-sulphur produced poor skin finish on Allington Pippin. Indifferent control of scab, and severe spray damage in the form of leaf-burn, leaf-drop, and fruit russeting resulted from weak Bordeaux mixture (1–1½–100) and bouisol (0·167 per cent. by weight). The addition of washed cottonseed oil (0·75 per cent. by volume) to Bordeaux mixture (1–1½–100) improved the control and obviated leaf-burn and leaf-drop, but failed to prevent fruit russeting. A strong Bordeaux mixture (6–9–100) gave the best control, but caused severe injury. Of the three apple varieties tested, Allington Pippin was the most susceptible to scab, and Newton Wonder was the most resistant to injury by sprays containing copper.

WELLMAN (R. F.) & HEALD (F. D.). **Steam sterilization of Apple boxes for blue mold.**—*Bull. Wash. St. agric. Exp. Sta.* 357, 15 pp., 1938.

In experiments on the effect of streaming steam on the spores of *Penicillium expansum* [*R.A.M.*, xvii, p. 505] known to be carried on apple picking boxes, the authors placed standardized suspensions of these spores on small blocks of apple box wood and exposed them to a stream of steam (either in an autoclave with the outlet valve fully open, in an Arnold sterilizer, or to direct steam over a flask of boiling water) for varying periods of time and then transferred the spores to 100 c.c. water, the colonies resulting from 1 c.c. of this suspension being taken as an index of efficiency of the treatment. Complete control was obtained by the first and third methods and almost complete control by the second method, after an exposure for one minute; an exposure for two minutes by the second method killed spores placed between two blocks of wood, simulating the joints of boxes. Spores dried for a fortnight were more readily killed than those dried for a few hours only, and

spores were more difficult to kill when mixed with decayed apple tissue. Since steam is available in most packing-houses, steam sterilization of old apple picking boxes, which are to be used again, is recommended for commercial practice, and an exposure to streaming steam for two minutes is considered sufficient to kill all spores of *P. expansum* present.

Degman (E. S.), Batjer (L. P.), Regeimbal (L. O.), & Magness (J. R.). **Further investigations on the use of boron for control of internal cork of Apples.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 165–168, 1938.

Applications of boron in the form of boric acid or borax (2/3 or 1 lb. per tree, respectively), in the late autumn or early spring, to the soil round the trunks of 18-year-old Black Ben Davis and 30-year-old Ben Davis apple trees in two orchards in West Virginia showing at least 80 per cent. internal cork [*R.A.M.*, xvii, p. 465] gave complete control of the disease, the treated trees averaging only 2 per cent. or less internal cork and a number being entirely unaffected. Injections of boric acid (3 gm. in each of 3 holes bored in the trunk) gave 0 to 40 per cent. cork in one orchard, apparently as a result of some of the vascular tissues supplying certain limbs being missed; when the injections were made in large limbs (3 gm. in each of 2 holes) effective control resulted. In both orchards the untreated control trees showed 58 to 100 per cent. cork.

Observations indicated that the disease is most prevalent in dry years and years of irregular rainfall. In the Shenandoah-Potomac fruit district internal cork is most severe on varieties of the Ben Davis group, including Gano, Black Ben Davis, and Ben Davis. It is common in Oldenburg and Yellow Transparent, and occurs occasionally in Rome Beauty, Grimes Golden, and Jonathan, but has not been found yet in Stayman Winesap, Delicious, or York Imperial. For the present, growers are recommended to make not more than one application of 1 lb. borax or 2/3 lb. boric acid per mature tree until the disease reappears.

Burrell (A. B.). **Control of internal cork of Apple with boron.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 169–175, 2 figs., 1 map, 1938.

In further experiments in 1937 in New York on the control of internal cork of apples [see preceding abstract], approximately 4 gm. of boric acid crystals were introduced in September in each of four or five $\frac{7}{16}$-in. holes, $2\frac{3}{4}$-in. deep, in the crowns of 27-year-old Fameuse apple trees. Other trees received $\frac{1}{2}$ and 1 lb. of fertilizer grade borax spread on the soil at the base in April. The injections (which are not recommended commercially) reduced internal cork from 36·45 per cent. to 0·22 per cent. (averages of 27 control and 27 treated trees). Soil applications at the rate of 1 lb. per tree reduced it from 13·4 per cent. to 0·06 per cent. (averages of 15 and 16 trees, respectively). The lighter soil applications reduced it from 24·99 to 0·1 per cent., approximately. Limited corroborative data were obtained from three other orchards.

Observations on about 15,000 apple trees commercially treated with soil applications of borax of from $\frac{1}{4}$ to 1 lb. per tree showed no foliage injury from the applications. Injury was observed, however, in 6 out

of 36 non-thrifty 3-year-old trees treated with soil applications of ¼ lb. per tree, the symptoms comprising thin and tapering shoots, small leaves towards the shoot tip, leaf-rolling, marginal scorching, blanching, and shedding. Trees in which injections were made in autumn showed about twice as much bark injury as those in which the injections were made in spring. Marginal scorching of young leaves resulting from applications of borax in sprays (2 lb. per 100 gals.) was lessened or eliminated by the presence of lime or lime-sulphur.

SMOCK (R. M.) & VAN DOREN (A.). **The histology of bitter pit in Apples.** —*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 176–179, 3 figs., 1938.

In a study of the anatomical characteristics of bitter pit [*R.A.M.*, xvi, pp. 688, 820; xvii, p. 399] in Baldwin, Northern Spy, McIntosh, and Gravenstein apples the condition was first noted in groups of cells from which starch had not disappeared, but these cell groups could not be identified as pit areas until a few cell walls had collapsed. Starch may persist in such cell groups without subsequent pitting. In the early stages of pit development, starch was often seen in the surrounding healthy cells, as well as in affected ones.

When the cell protoplasm had become plasmolysed, and some of the walls had collapsed, discoloration of the cells was so pronounced that the bitter pit lesions were visible to the naked eye through the skin. As the pit developed, some but not all of the cell walls tore and broke down; in severely affected areas the collapsed walls formed bands binding cavities formerly occupied by four or more normal cells. Starch grains were always included between the collapsed cell walls, though the surrounding cells were starch-free. Starch persistence may, however, be concomitant with bitter pit, rather than the cause of it [cf. *R.A.M.*, vii, p. 102, *et passim*]. No thickening of the cell walls was observed. In the early stages, the epidermal and hypodermal region was unaffected; the hypodermal cells were not affected until the pitting had become very severe. When the skin had become depressed over the pitted area the hypodermal cells sometimes appeared slightly collapsed, with occasional tearing of the walls.

Pits in fruits on the tree were of the same type as those in stored fruits, storage pit being, apparently, only a delayed appearance of pitting in predisposed fruits. Contrary to McAlpine's views (Bitter pit investigations, 1911–16) no evidence was obtained that vascular bundles associated with the pits were less fully developed or in any way less normal than bundles in unaffected areas. Pits were always associated with vascular bundles.

Scald in Jonathan Apples.—*Fruit World, Melbourne*, xxxix, 5, p. 17, 1938.

Investigations conducted in Victoria during recent years established that apple scald [*R.A.M.*, xvii, pp. 399, 463, 464] may be bad in some seasons while in others under apparently the same storage conditions the disease may not appear. Two sets of factors are involved, viz., storage and pre-storage factors. Scald has been found to be definitely a low temperature disorder occurring mostly (80 per cent. affected in one experiment) at 32° F., slightly (20 per cent.) at 34°, and not at all above 36°.

It develops relatively quickly in cool storage, and apples which have not developed scald within two to three months of storage remain free from it even when further stored at 32°. It is, therefore, recommended to store Jonathans at 36° until the end of April, then at 34° till the end of May, and thereafter at 32°, thus ensuring a fresh condition of the fruit which would have suffered from continuous storage at 36°. Of the pre-storage factors affecting the development of the disorder, the main one is the maturity of the apples at picking time. Early picked Jonathans proved to be not very susceptible to scald, while fruit picked, in a normal year, towards the end of March, when it possesses maximum flavour, aroma, high colour, and a crisp and juicy flesh, was very susceptible. It was also found that a high temperature of the apple prior to storage greatly favoured the development of scald. Growers are advised, therefore, not to place warm Jonathan apples directly in the store, but to let them cool off overnight first, a procedure which would incidentally greatly lessen the task of the cool store engineer in cooling down the fruit to the usual storage temperatures.

MacDaniels (L. H.) & Hildebrand (E. M.). **Results of further studies on the effect of bactericides on pollen germination and fruit set.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 14–23, 1938.

Further studies [which are described, and the results of which are tabulated] carried out from 1934 to 1937, inclusive, in New York on the effect of bactericides applied to the open blossoms upon the set of apple fruits [*R.A.M.*, xvii, p. 607] showed no serious reduction in fruit set from the bactericides tested, especially Bordeaux mixture (1–3–50) and copper-lime dust (20–80), which were less detrimental than lime-sulphur and other sulphur compounds. Practically no fruit russeting or other serious foliage damage resulted from the experiments. Preliminary tests indicated that the effects on pear and quince will prove to be similar to those on apple.

Ridgway (H. W.). **A case of rosette on Apple in Virginia.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 227–229, 1 fig., 1938.

In 1933, a 13-year-old Golden Delicious apple tree in Virginia showed symptoms of rosette [little leaf: *R.A.M.*, xvii, p. 327], consisting of defoliation of the older leaves, small, narrow, chlorotic leaves at the tip of the new growth, spindling twigs with short internodes and narrow crotch angles, and reduction of fruit set on the affected branches. In April, 1935, 3 lb. commercial zinc sulphate was spread on the ground round the base of the trunk, and a month later a severely affected branch was sprayed with a mixture containing 8 lb. zinc sulphate, 8 lb. lime, 2 lb. lead arsenate, and 10 lb. flotation sulphur paste. As no marked improvement was noted, 4 holes $\frac{3}{4}$ in. wide and $1\frac{1}{2}$ in. deep were bored in a main branch in April, 1936, filled with commercial zinc sulphate, and plugged with wax. By 1937, the growth of this branch was almost normal, though the untreated branches showed typical symptoms. In 1936, the same condition was noted on another Golden Delicious tree and on *Liriodendron tulipifera* trees in the vicinity. This is the first report of zinc deficiency in apple districts in the United States east of the Rocky Mountains.

DAVIS (L. D.) & MOORE (N. P.). **Black-end of Pears. V. Seasonal changes in P_H of the fruit.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 393–401, 6 graphs, 1938.

In further investigations on black end of Bartlett pears [*R.A.M.*, xvii, p. 297] in California a study was made of the seasonal changes in the P_H value of the calyx end, mid-section, and stem end of fruits from normal and affected trees, full data on which are given. Fruits from black-end trees were consistently more alkaline than those from normal trees throughout the season, but did not become markedly so until just before the rapid increase in the number of black-end fruits. This suggests a close relation between the two phenomena, occurring before the disease becomes visible.

WORMALD (H.). **Two ornamental shrubs as hosts of the organism causing Plum bacterial canker.**—*Rep. E. Malling Res. Sta., 1937*, pp. 198–200, 3 figs., 1938.

Pseudomonas mors-prunorum, the organism causing bacterial canker of plum trees [*R.A.M.*, xvii, p. 13], was isolated from bacterial spots on the leaves and lesions on the shoots and stems of young almond trees from a nursery in Berkshire, and from a similar lesion on a stem of the purple-leaved plum (*Prunus pissardi*) received from Swanley Horticultural College, Kent. The portions of almond stems examined had dead tips and discoloured areas round the nodes, the leaves showed irregular blotches and roughly circular spots, 1 to 2 mm. in diameter, with a dark brown centre and a pale green zone surrounding it. The portion of the stem of *P. pissardi* examined had a discoloured bark and was girdled by a canker. Inoculations of Victoria plum trees with bacterial strains from *P. pissardi* and from almond leaf and stem spots resulted in the development of cankers.

WORMALD (H.) & GARNER (R. J.). **Manurial trial on nursery trees with reference to effect on Plum bacterial canker.**—*Rep. E. Malling Res. Sta., 1937*, pp. 194–197, 1938.

In experiments carried out at East Malling from 1932 to 1936 young plum trees were treated with various fertilizers and then inoculated with *Pseudomonas mors-prunorum* [see preceding abstract]. None of the manurial treatments reduced susceptibility to the organism to any appreciable extent, and there was some indication that applications of lime may even increase it.

RADA (G. G.). **La enfermedad del 'mildiú' u 'Oidium' del Melocotonero en Arequipa.** [The 'mildew' or 'Oidium' disease of the Peach in Arequipa.]—*Inf. Estac. Agric., Lima*, 45, 9 pp., 12 figs., 1938.

Peach trees in the Arequipa Department, Peru, are stated to have sustained heavy damage since 1933 from mildew (*Sphaerotheca pannosa*) [*R.A.M.*, xvi, pp. 21, 474; xvii, p. 589], other local hosts of which include yellow plums, nectarines, and roses.

DUNBAR (C. O.) & ANTHONY (R. D.). **Two cases of potassium deficiency in Peach orchards in South Central Pennsylvania.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 320–325, 4 figs., 1938.

In June, 1937, approximately one-third of a number of 7-year-old

Elberta peach trees in an orchard in Pennsylvania failed to crop; the leaves were pale olive-green, and showed edges bordered with red, but marginal disintegration was only occasionally found. Nearly all the leaves were crinkled along the midrib, and laterally rolled towards it, forming a cylinder in extreme cases, with the under surface of the leaf exposed and revealing considerable light red to pink discoloration. Terminal growth was of almost normal length, but very slender. Chemical analysis of the affected leaves showed them to be low in potassium and nitrogen. Applications of potash fertilizers (3 lb. nitrate or sulphate of potash per tree) remedied the disorder, whereas no other treatment was efficacious. In another locality the same condition responded satisfactorily to applications of potash.

CATION (D.) & ROBERTSON (C. W.). **Basi cop as a Cherry spray.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xx, 4, pp. 199–210, 4 figs., 1 graph, 1938.

In one year's comparative spraying tests against cherry leaf spot (*Coccomyces hiemalis*) carried out in Michigan [*R.A.M.*, xvi, p. 544], basicop (a powdered form of basic copper sulphate, the formula of which is given as $CuSO_4 2Cu(OH)_2$), used with lime (3–8–100), gave satisfactory control with little visible injury [ibid., xvii, p. 608]. When 1 lb. or less of lime was used, basicop in some cases caused copper injury, while when used alone (1½–100) it failed to give satisfactory control, though much superior to liquid lime-sulphur (2½–100). Bordeaux mixture (3–4–100 and 6–8–100) gave satisfactory control, but tended to dwarf the fruit in proportion to the concentration used; in one experiment, however, two pre-harvest applications at a strength of 4–5–100 did not cause fruit-dwarfing.

HARRIS (R. V.). **A bibliographical note on the distinction between mild and severe Strawberry crinkle.**—*Rep. E. Malling Res. Sta., 1937*, pp. 201–202, 1938.

Summing up present knowledge on the crinkle disease of strawberries [*R.A.M.*, xvi, p. 762] the author states that mild crinkle, first differentiated by Zeller in the United States [ibid., xiii, p. 313] from a possibly separable component of crinkle causing more severe symptoms, corresponds with the disease recognized by Ogilvie, Swarbrick, and Thompson [ibid., xiii, p. 642] in England in 1934 and found later at East Malling by Harris [ibid., xvi, p. 762]. The available data indicate that there is a definite etiological distinction between the two forms of crinkle, the precise nature of which remains to be determined. Mild crinkle was observed to be widely distributed in England in areas where severe crinkle was comparatively rare, and Massee (on p. 98 of this report) has shown that the aphis *Capitophorus fragariae* Theob. is the vector of the former. The author suggests that severe crinkle is either due to a virus which can act independently of the mild crinkle virus, or to one which causes the symptoms of severe crinkle in the presence of the mild crinkle virus.

PLAKIDAS (A. G.). **The mode of action of Bordeaux on Mycosphaerella fragariae.**—*Phytopathology*, xxviii, 5, pp. 307–329, 1 fig., 1 diag., 1938.

A detailed, tabulated account is given of studies at the Louisiana

Agricultural Experiment Station to determine the mode of action of Bordeaux mixture on strawberry leaf spot (*Mycosphaerella fragariae*) [*R.A.M.*, xvii, p. 402].

The fungicide was shown to be without influence on the development of the mycelium within the host tissue, but it exercised a strongly inhibitive action on sporulation on the upper surface of infected foliage, between 7 and 10 times as many conidia being counted on unsprayed as on treated leaves. The conidia of *M. fragariae* were found to be extremely sensitive to copper toxicity. In direct contact with freshly prepared 4–4–50 Bordeaux mixture, germination was completely inhibited by as high a dilution as 1 in 1,000, while even at 1 in 10,000 and 1 in 20,000 a certain degree of toxicity was apparent. No germination occurred, moreover, among conidia placed in contact with Bordeaux dried and aged on glass slides for periods ranging from a week to over a year, or weathered on leaves in the field for 50 days. The ungerminated spores appeared from their coagulated protoplasm to be dead at the end of 24 hours, while exposure of aqueous suspensions of conidia for the same period to contact with the mixture on leaves sprayed ten days earlier was also lethal. The conidia failed to germinate in the supernatant clear liquid of fresh 4–4–50 Bordeaux; in the supernatant liquid of the fungicide dried on glass the germ-tubes assumed abnormal shapes. Separation of the conidia from the mixture by a partition of filter paper did not prevent their destruction or permanent injury by exposures of 30 minutes or longer, no germination ensuing on their removal from the sphere of influence of the fungicide and washing. When the spore suspension was connected with dry Bordeaux smears on glass slides by means of narrow water bridges, no germination occurred at distances of 1, 2, or 3 mm., while at 5, 10, and 16 mm. the process was initiated but soon ceased. Solutions of 1 in 250,000 copper sulphate, 1 in 500,000 copper chloride, and 1 in 400,000 copper acetate were lethal to the ungerminated conidia. At higher dilutions, e.g., 1 in 500,000 to 1 in 1,000,000 copper sulphate only rudimentary germination took place; at 1 in 4,000,000 the process was normal. Lime proved to be non-toxic.

It is concluded that the action of Bordeaux mixture on *M. fragariae* is mainly eradicative in character.

Simmonds (J. H.). **Alternaria passiflorae n.sp., the causal organism of brown spot of the Passion Vine.**—*Proc. roy. Soc. Qd*, xlix, 13, pp. 150–151, 1 pl., 1938.

The *Alternaria* causing brown spot of passion fruit (*Passiflora edulis*) and also affecting *P. alba*, *P. quadrangularis*, *P. herbertiana*, and *P. incarnata* in Australia [*R.A.M.*, x, p. 394; xv, p. 593] is now named *A. passiflorae* n.sp. [with a Latin diagnosis]. The conidiophores are solitary or caespitose, brown, hyaline towards the apex, simple or rarely branched, sparsely geniculate, bearing conidia singly or, in culture, in chains averaging 2·5 individuals. The conidia are oblong, brown, with 5 to 13 (average 8·7) transverse septa and few or no longitudinal septa (average 2·5), frequently bear a beak 3 to 4μ broad, simple or with 1 to 5 branches, and flexuous towards the base in culture, and measuring

without the beak 44 to 135 by 14 to 27μ, averaging 83 by 20μ, or with the beak 106 to 253μ long.

HEINICKE (A. J.). **How lime sulphur spray affects the photosynthesis of an entire ten-year-old Apple tree.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 256–259, 1938.

When a 10-year-old Baldwin apple tree pruned on 14th June, 1937, and placed in a specially constructed glass assimilation chamber was sprayed with lime-sulphur (1 in 40) on the night of 6th–7th July, another pruned tree being kept in a similar chamber, unsprayed, as a control, during the five days following the first spray application the foliage of the treated tree was only about one-half as active as it had been during the preceding six days, while the control tree showed a slight increase in the average daily rate of photosynthesis [*R.A.M.*, xv, p. 727]. The reduction due to the spray in this 5-day period alone represented a loss of dry matter equivalent to that found in about half a bushel of mature apples. Slight burning of the leaf margins, involving not over 5 per cent. of the total leaf area, occurred on the second day after spraying. Within 15 days from the date of the first spraying the tree had apparently recovered, and new, unsprayed leaf had appeared. After the second spraying, on the night of 21st–22nd July, there was again an appreciable reduction in photosynthetic activity during the ensuing 5 days, though, with reference to the control, less marked than after the first spraying.

The data indicated that reduction in photosynthetic activity following lime-sulphur spraying is especially severe if the mean temperature is high during the week following the application. The small amount of burning noted was not alone enough to account for the reduction, photosynthesis being evidently influenced by the spraying in such a manner that the rate of assimilation of unscorched leaf surface was reduced.

These results are not considered to warrant the view that lime-sulphur should be discarded as a fungicidal spray, but in cases where fungal diseases can be controlled by milder sprays, such as wettable sulphurs, cumulative benefits may be expected from their use, resulting from the greater photosynthetic activity of the leaf surface.

KEARNS (H. G. H.), MARSH (R. W.), & MARTIN (H.). **Combined washes. Progress report. IV. The phytocidal properties of petroleum oil sprays alone and in combination with lime-sulphur.**—*Rep. agric. hort. Res. Sta. Bristol, 1937*, pp. 65–77, [1938].

Further extensive field trials with combined insecticidal-fungicidal sprays carried out in 1937 at Long Ashton and elsewhere [*R.A.M.*, xvi, p. 817] again demonstrated that a combined wash of a grade G petroleum oil-sulphite lye emulsion, lime-sulphur, and nicotine may safely be applied to all apple varieties tolerant of sulphur. The addition of the petroleum oil emulsion to a petal fall lime-sulphur wash did not reduce the control of scab [*Venturia inaequalis*] as compared with that given by a lime-sulphur-sulphonated lorol mixture of the same lime-sulphur content, but may have reduced the number of apples picked.

Porges (N.). **A fungus in acid copper plating baths.**—*Metal Ind., N.Y.*, xxxvi, 1, pp. 19–20, 1938.

The writer records the occurrence, hitherto apparently unknown, of a fungus forming medusa-like colonies, up to ½ in. in diameter, in an acid copper-plating bath containing 6·8 per cent. sulphuric acid and copper sulphate to saturation. The fungal particles moved with the current, adhered to the metal, and became covered with copper; on removal from the bath they were rubbed off by the burnisher, leaving bare spots on the plated object. Pure cultures of the organism were found to make very slight growth on Czapek's solution with the addition of copper sulphate, whereas profuse development occurred on Czapek's solution plus sulphuric acid but no copper. Tap water was commonly used for the baths, and the fungus, when grown in this medium with the addition of 3 per cent. sugar, formed the typical medusa-like growths observed in the original bath liquor. The identity of the fungus is still under investigation.

Taborda de Morais (A.). **Notice sur le dépérissement de la Zostera marina L. au Portugal.** [A note on the dying-off of *Zostera marina* L. in Portugal.]—*Bol. Soc. broteriana*, Sér. II, xii, pp. 221–223, 1937. [Received August, 1938.]

Attention is drawn to the occurrence on the banks of the Ria de Aveiro lagoon, on the west coast of Portugal, of the wasting disease of *Zostera marina* [*R.A.M.*, xvii, p. 543]. Since the first destructive onset of the malady in 1931–2 [ibid., xii, p. 712], the grass-wrack has made no fresh growth, and the consequent loss of this valuable manure imposes considerable hardship on the local peasantry.

Porter (C. L.) & Carter (J. C.). **Competition among fungi.**—*Bot. Rev.*, iv, 4, pp. 165–182, 1938.

This is an up-to-date review of the literature [181 titles of which are cited in the bibliography appended] dealing with the competition of fungi among themselves and with other micro-organisms, some aspects of which have been noticed from time to time in this *Review*.

Dusseau (Aline). **Premières cultures de champignons sur cellophane.** [First cultures of fungi on cellophane.]—*C.R. Acad. Sci., Paris*, ccvi, 22, pp. 1672–1673, 1938.

The author has obtained satisfactory cultures of various species of *Fusarium*, *Aspergillus*, and *Penicillium* on sheets of cellophane (cellulose acetate), which affords a convenient substitute for filter paper as the sole source of carbon. Pigmentation, notably in *F. arthrosporioides* [*R.A.M.*, xi, pp. 17, 745] and *F. sambucinum* [ibid., xvi, p. 434; xvii, p. 168], develops more rapidly on cellophane than on filter paper, while the transparency of the former substratum facilitates observation and photography.

Wyckoff (R. W. G.). **Le poids moléculaire des virus-protéines des plantes.** [The molecular weight of the virus proteins of plants.]—*C.R. Soc. Biol., Paris*, cxxviii, 14, p. 1396, 1938.

The data herein presented on the molecular weights of certain plant virus proteins have mostly been published and noticed in this *Review*.

Mostafa (M. A.). **Mycorrhiza in Tropaeolum majus L. and Phlox drummondii Hook.**—*Ann. Bot., Lond.*, N.S., ii, 6, pp. 481–490, 7 figs., 1938.

Tropaeolum majus and *Phlox drummondii* roots in the Zaafran Palace Garden, Cairo, were found to contain an endophytic fungus. In *T. majus* the well-developed endotrophic mycorrhiza with vesicles and arbuscules [of the common Phycomycetoid endophyte type: *R.A.M.*, xvi, pp. 47, 621, 822; cf. ibid., xvii, p. 263] was present. In *P. drummondii* the endophyte is generally similar to the foregoing, but intracellular hyphal clumps are usually formed in addition to the arbuscules, and vesicles are rarely encountered, the few that are formed showing occasional transverse septa. From young roots of *T. majus* disinfected in mercuric chloride 1 in 1,000 for from 30 seconds up to 2 minutes the author isolated a sterile septate mycelium, and inoculations of sterilized seeds with it in sand and agar cultures resulted in earlier germination; sections of the roots of inoculated seedlings were found to contain the fungus and its arbuscules. A sterile mycelium was also isolated from the roots of *P. drummondii*, but seed inoculated with it revealed no trace of a fungus. The endophyte under discussion is regarded as belonging to the *mycelia sterilia*.

Miller (F. J.). **The influence of mycorrhizae on the growth of Shortleaf Pine seedlings.**—*J. For.*, xxxvi, 5, pp. 526–527, 1938.

An experiment was carried out on old farmland in Missouri in 1937 to determine the influence of mycorrhiza on the growth of shortleaf pine [*Pinus echinata*] seedlings. Three plots were laid down, of which (1) had been planted with shortleaf pine in 1935 and cowpeas in 1936, (2) with shortleaf pine in 1935 and hardwoods in 1936, and (3) with shortleaf pine in 1935 and transplants of the same species in 1936. On 13th September the average root length of the seedlings in plots (1), (2), and (3) was 4, 5, and 6 to 8 in., respectively, and the number of laterals 8, 10, and 10 to 12, respectively; mycorrhiza were absent in (1), sparsely present in (2), and abundant in (3). On old farm soil, therefore, mycorrhiza are evidently essential to the vigorous development of *P. echinata* and should be introduced on transplants, which bear a sufficient number to maintain thriving growth. A further point to be borne in mind is the necessity of building up the organic matter in such soils to a point approaching natural forest conditions, so that the mycorrhiza have something to grow on during the fallow year. For this purpose a desirable succession is a soiling crop the first year, pine transplants the second, shortleaf pine seedlings the third, and so on.

Nisikado (Y.), Hirata (K.), & Higuti (T.). **Studies on the temperature relations to the longevity of pure culture of various fungi, pathogenic to plants.**—*Ber. Ōhara Inst.*, viii, 2, pp. 107–124, 4 graphs, 1938.

In further studies at Kurashiki, Okayama, Japan, on the influence of temperature on fungal longevity [*R.A.M.*, xvii, p. 128] test-tube cultures were kept at temperatures of 0°, 5°, 10°, 15°, 20°, 25°, 30°,

and 35° C., and the viability tested at monthly intervals. The following organisms survived 34 months (the maximum duration of the experiments) on steamed rice straw at all temperatures from 0° to 20° inclusive: *Hypochnus centrifugus* [*Corticium centrifugum*] from Dutch iris, *H.* [*C.*] *sasakii* from wheat, *Gibberella fujikuroi* from rice, *Ophiobolus miyabeanus* from rice, *Pyrenophora graminea* [*Helminthosporium gramineum*] from barley, *Fusarium niveum* [*Calonectria graminicola*], *H. nodulosum* from *Eleusine indica* [cf. ibid., xv, p. 426], and *Macrosporium* [*Alternaria*] *porri* from onion [see above, p. 654]; from 0° to 15°: *G. saubinetii* from barley and *Sclerotinia trifoliorum* from *Astragalus sinicus*; from 0° to 10°: *Ceratostomella piceae* from blue-stained sapwood of *Kalopanax* [*Acanthopanax*] *ricinifolium*, *C. pini* from similar material of *Pinus densiflora*, *Cephalosporium gramineum* from wheat [ibid., xvii, p. 593], and *Cercospora kaki* from persimmon; and from 0° to 5°: *Ceratostomella ips*. At 30°, *G. fujikuroi*, *O. miyabeanus*, and *H. nodulosum* were viable for 28 to 29 months, *Corticium sasakii*, *A. porri*, and *Septoria lactucae* from lettuce for 11 to 16, and the other species tested for only 3 to 5 months. At 35° none of the fungi under observation survived for more than 5 months, except *H. nodulosum*, which was still alive after 16.

The temperature relations of *Piricularia oryzae* from rice approximated to those of most of the other test organisms in respect of heat, but were quite different as regards reaction to cold, the survival periods being only 1 to 2 months at 0° and 3 to 4 at 5°. *P. zingiberi* from *Zingiber mioga*, on the other hand, remained viable for at least 8 months at 0°. *Phytophthora melongenae* [*P. parasitica*: ibid., xv, p. 633] from egg-plant reacted similarly to *Piricularia oryzae*, withstanding temperatures of 0°, 5°, 10°, 15°, 20°, 25°, 30°, and 35°, for 2, 2, 12, 12, 9, 7, 3 months, and less than 1 month, respectively.

EHRKE (G.). **Die Kartoffelbeizung in Hinblick auf die Bekämpfung der Rhizoctonia und des Kartoffelschorfes.** [Potato disinfection in relation to the control of *Rhizoctonia* and Potato scab.]—*Pflanzenbau*, xiv, 11, p. 426–440, 1938.

Following a discussion on the advantages of disinfection of potato tubers against *Rhizoctonia* [*Corticium solani*] and scab [*Actinomyces scabies*], much of which has already been noticed from another source [*R.A.M.*, xvii, p. 481], the author describes an experiment on the treatment of potato tubers with aretan (0·15 per cent. for 25 minutes) [ibid., xvii, p. 586]. The treatment reduced the amount of scabbed potatoes from 5 kg. per 50 kg. in the control to 2 kg. per 50 kg. and increased the yield by 6·3 per cent., but did not give appreciable control of *C. solani*; fewer large tubers and more medium-sized and small potatoes were produced by the treated seed than by the control. Treatment with mercuric chloride resulted in 0·5 kg. scabbed potatoes per 50 kg. and gave good control of *C. solani*, but it reduced the yield by 4·5 per cent. Admitting the beneficial effect of tuber disinfection the author points out that it affects only the parasite attached to the surface of the tubers and that a method dealing with soil infestation as well would be more effective. He suggests that a desirable solution would be the preparation of a fertilizer with the addition of either inorganic

mercury compounds or of other substances equally effective in control of the two diseases.

LEPIK (E.). **Beitrag zur Beizung der Pflanzkartoffeln.** [A contribution to seed Potato disinfection.]—*Mitt. phytopath. VersSta. Univ. Tartu*, 49, 6 pp., [?1938. Received July, 1938.]

A brief summary is given of some outstanding contributions to the improvement of seed potato disinfection in Europe and the United States, followed by a note on preliminary experiments in 1936 in Estonia on the control of *Hypochnus* [*Corticium*] *solani* by 30 minutes' immersion in 0·10 per cent. mercuric chloride and 0·15 per cent. aretan [see preceding abstract]. The latter gave the better results, producing an average of 15·6 tubers for 30 plants compared with 13·1 and 11·6 for the mercuric chloride-treated and control series, respectively, while the numbers of completely healthy tubers in the aretan- and mercuric chloride-treated and control plots were 155, 106, and 6·3, respectively.

LEACH (J. G.). **The biological basis for certification of seed Potatoes.**—*Amer. Potato J.*, xv, 5, pp. 117–130, 1938.

Following an explanatory statement concerning the main objective of seed potato certification [see next abstract], namely, the production for distribution of supplies of tubers combining adherence to variety and type with freedom from disease, the writer summarizes the relevant information on some of the disorders involved in the work, viz., viruses, scab [*Actinomyces scabies*], *Rhizoctonia* [*Corticium solani*], *Fusarium* wilts [*F. oxysporum* and *F. solani* var. *eumartii*: *R.A.M.*, xvii, p. 409], *Verticillium* wilt [*V. albo-atrum*], 'Z' disease [ibid., xvi, p. 708], blackleg [*Erwinia phytophthora*], late blight [*Phytophthora infestans*], bacterial wilt (*Phytomonas* [*Bacterium*] *solanacearum*), bacterial wilt and ring rot [ibid., xvi, p. 628], purple top wilt (probably identical with blue stem [ibid., xvii, pp. 480, 552]), and hair or spindling sprout [ibid., xvi, p. 118].

In connexion with the mode of transmission of blackleg, evidence is adduced from an unpublished manuscript by R. Bonde of the comparative unimportance of the seed in the perpetuation of this disease [ibid., xv, p. 483], the certification requirements in connexion with which should be amended in the light of recent information. Epidemics of blackleg are more likely to arise as a result of contamination by way of the soil, through fungal lesions, or from the infection of seed injured by the successive drying of freshly cut surfaces, unfavourable storage conditions, or infestation by certain insects than from the presence of a small number of diseased plants in the field producing the seed stock.

On account of its destructive character and ready transmission through infected tubers, no plants suffering from bacterial ring disease should be allowed in certified fields pending a more thorough study of the disease.

The course of purple top wilt indicates the possible implication of a toxicogenic insect as in the case of psyllid yellows [ibid., xiv, p. 117], but in the absence of more accurate information all seed certification regulations must necessarily be tentative.

Spindling (hair) sprout has only recently begun to occur in destructive amounts such as developed from many of the tubers grown in 1937, especially of the Triumph and White Rose varieties. A possible connexion between this disease and purple top wilt has been suggested, but the available evidence is inconclusive. Until further information is forthcoming a tolerance of 5 per cent. spindling sprout is advocated.

As regards the *Fusarium* wilts, a limit of tolerance based on stem-end discoloration rather than on bin inspection is recommended.

EDGERTON (C. W.). **Report of seed certification conference.**—*Amer. Potato J.*, xv, 5, pp. 130–140, 1938.

Among the numerous items of interest in the reports of the various committees presented at a conference to discuss problems relating to seed potato certification [see preceding abstract] held at Baton Rouge, Louisiana, from 5th to 8th April, 1938, the following may be mentioned. R. J. Haskell stated that up to 35 per cent. infection by bacterial ring disease [loc. cit] has been observed in Maine, with an average of 5 to 10 per cent. for certain areas. In Florida in 1937 the loss from the disease was estimated by Eddins at $100,000. All the commonly grown varieties, such as Spaulding, Rose, Katahdin, Triumph, and Green Mountain, are affected. Experiments in Florida have shown that 10 or 11 per cent. infected plants may be expected to develop from stock carrying 1 per cent. visibly diseased tubers.

Hair sprout [loc. cit.] can be detected, according to E. M. Gillig's report, only by germinating the tubers, necessitating the previous warming-up of a sufficient number of representative samples to give a fair idea of the percentage of the disorder.

The provisions of the joint report of the Regulations and Correlations Committees (presented by J. H. Montgomery) are cited; they include a tolerance limit (at time of shipment) of 5 per cent. each of hair sprout and net necrosis [*R.A.M.*, xvii, p. 478], 1 per cent. spindle tuber [ibid., xvi, pp. 487, 489], 4 per cent. *Fusarium* stem-end discoloration, and 1 per cent. *Sclerotium rolfsii* [ibid., xiii, p. 273].

MADER (E. O.) & WATKINS (T. C.). **Effects of Bordeaux mixture on the control of yellow dwarf Potatoes.**—*Phytopathology*, xxviii, 5, p. 375, 1938.

In experiments at Ithaca, New York, to determine the possibility of combating yellow dwarf of potatoes [*R.A.M.*, xvii, p. 478] by the suppression of the insect vector, *Aceratagallia sanguinolenta*, Bordeaux mixture was applied at various rates to the foliage at intervals during the 1936 season. After overwintering in storage the tubers were indexed for yellow dwarf in 1937, when it was found that only 14 out of 4,813 treated plants were diseased as compared with 64 out of 1,955 unsprayed. This reduction (from 3·3 to 0·3 per cent.) would be of importance in connexion with seed certification. There was no significant difference in the numbers of leafhoppers in the sprayed and control plots, and it is thought that the copper assimilated by the plants in the course of the treatment may render the virus partially or completely non-infectious.

Harvey (R. B.). **The X-ray inspection of internal defects of fruit and vegetables.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 156–157, 1938.

During 1937, observations in Minnesota with a portable X-ray machine indicated that the incidence of hollow heart [*R.A.M.*, xv, p. 821; xvii, p. 410] in the locally grown potato varieties appeared to be greatest in Irish Cobbler, followed in descending order by Katahdin, Rural and Rural Russet, Burbank Russet, Green Mountain, Chippewa, Early Ohio, Bliss Triumph (in which no hollow heart was found), and Warba and Red Warba (which do not crack internally, but may show bad external cracks). The splits are oriented with the direction of cleavage in the medulla along visible lines where cell walls run parallel, and in Irish Cobbler radiating from the centre. In Burbank Russet and Early Ohio clefts tend to form across the tuber, and in long potatoes two or three transverse clefts may sometimes be joined together by a longitudinal cleft through almost the entire length of the medulla.

By examining every tuber in a few 100 lb. bags of Irish Cobbler potatoes hollow heart incidence in one truck-load was found to range from 27 to 37 per cent. A large sample of several hundred pounds must therefore be examined to form a true idea of the percentage of tubers affected in any lot, making grading by cutting open impracticable. The solution of the problem lies in X-ray inspection, by which about 7,500 lb. per hour can be sorted with one machine. Clefts in potatoes can be seen by X-rays through 1 ft. peat, 6 in. loam, or 3 in. sand, using high voltages on the portable machine. Potatoes may therefore be examined while still growing in the soil, if a suitable observation trough is used.

In Irish Cobbler potatoes hollow heart appeared to be most prevalent in light sandy soil, followed in descending order by clay loam, gumbo, sandy shallow peat, and deep peat. Incidence appears to be higher in northern than in southern Minnesota.

Unpublished data by F. Johnston indicate that defects and functional diseases in apples can also be detected by X-rays. The same methods have also been applied to the citrus fruits [ibid., xvi, p. 668] which can be sorted at the rate of 75 to 150 boxes per hour by this means.

Smerdon (R.). **A simple method of sulphur dusting.**—*Trop. Agriculturist*, xc, 5, pp. 274–275, 1938.

A simple method of applying sulphur dust [to *Hevea* rubber against *Oidium heveae*], which would appear to solve the problem of dusting small-holdings whose proprietors cannot afford to purchase machinery, consists in loosely filling small bags made of old sacking with 2 or 3 lb. sulphur and tying them, top and bottom, to the ends of poles about 25 ft. high, the pole then being agitated while held in a perpendicular position, and a cloud of sulphur being liberated over the tree. It is stated that Sinhalese labourers [in Ceylon] become very expert at liberating the required amount and in suitable weather conditions four men can easily dust 100 acres in one day, extra labour being required for transport.

Stevenson (J. A.). **A note on Hop anthracnose.**—*Plant Dis. Reptr*, xxii, 8, pp. 125–126, 1938. [Mimeographed.]

A specimen of hops found at Argonne, Wisconsin, was characterized

by numerous amphigenous lesions on the leaf blades and petioles, sometimes bounded by the veins, but often arranged along them. The circular, later angular to irregular, dull light-brown to ashen spots measured 1 to 2 mm. in diameter, sometimes coalesced, had raised margins on both surfaces, and sometimes became perforated at the centre. The older portions of the spots showed the presence of pink, later faded, acervuli, bearing straight, occasionally slightly curved, conidia, 7 to 18 by 3 to 5μ, identified as the conidial stage of *Glomerella cingulata*. Several specimens apparently of the same disease have been found in the Mycological Collections dating from 1890, while anthracnose due to a species of *Colletotrichum* was recorded on cultivated hops in New York State in 1923.

NEERGAARD (P.). **Mykologiske Notitser. 1.** [Mycological notes. 1.]—*Bot. Tidsskr.*, xliv, 3, pp. 359–362, 1938. [English summary.]

From a careful study of herbarium material of *Ascochyta lactucae* Rostr. [1882] on lettuce the writer concludes that this species is identical with *Septoria lactucae* Pass. [1879: *R.A.M.*, ix, p. 224] but not with *A. lactucae* Oud. [1901] as stated by J. Lind. (Danish Fungi as represented in the Herbarium of E. Rostrup, Copenhagen, 1913). Rostrup's Latin diagnosis (1894) of a new species of *Ascochyta*, *A. suberosa*, also found on lettuce stalks forming brown, elliptical, often confluent lesions, is here published for the first time. This species is characterized by pycnidia measuring 90 to 120μ in diameter and ovate to fusoid, continuous or uniseptate spores, 9 to 14 by 3 to 4μ (average 12·3 by 3·2μ). *A. suberosa* may possibly be identical with *Diplodina lactucae* (Oud.) Sacc. & Sydow (*A. lactucae* Oud.), which has uniseptate, oblong spores, rounded at both ends, measuring 12 to 15 by 3·5μ.

Phoma nemophilae n.sp., with cylindrical conidia, rounded at the ends, unicellular or rarely 1-septate, 4·5 to 9 by 1 to 2μ, was found on seeds and seedlings of *Nemophila insignis* and *N. atomaria* [*N. menziesii*] in Holland and Denmark.

The widespread pathogen of carrot seed hitherto known as *Alternaria radicina* [ibid., xvi, p. 438] is transferred to *Thyrospora* as *T. radicina* (M., D., & E.) n.comb. During the last three years 24 per cent. of the samples tested were found to be infected by this fungus. Paris Market carrot seed was observed in 1937 to be contaminated by *A. brassicae* (Berk.) var. *dauci* (Kühn) Bolle [ibid., xv, p. 769].

JØRSTAD (I.). **Adventive elementer og nytilgang på verter innenfor vår rustsoppflora.** [Adventive elements and new host accessions in our rust fungus flora.]—*Nyt Mag. Naturv.*, lxxviii, pp. 153–200, 1938. [English summary.]

Rust fungi which have been introduced into Norway, or which parasitize introduced hosts, are grouped as follows: (1) species of recent introduction, including *Puccinia asparagi* on asparagus and *Uromyces betae* on beet, both detected for the first time in 1937, *U. caryophyllinus* on carnations, in part of English or French origin (1921), and *Puccinia chrysanthemi* on chrysanthemums from England (1904); (2) species that cannot be regarded as indigenous, but the time of introduction of which is unknown, viz., *P. anomala* on barley and *P. porri* on

species of *Allium*; (3) collective species comprising both indigenous and introduced races, viz., *P. caricis*, including *P. pringsheimiana* on *Carex goodenowii* and various species of *Ribes*, and *P. coronata* [*P. lolii*], *P. glumarum*, *P. graminis*, *P. secalina*, and *P. triticina* on cereals; (4) indigenous species parasitizing introduced hosts, among them *Gymnosporangium clavariaeforme* on pear and various *Crataegus* spp. [*R.A.M.*, vii, p. 34; xvii, p. 535] and *Juniperus communis*, and *P. ribis* on red currants [ibid., xiii, p. 173], especially the widely cultivated Viking variety, and *Ribes schlechtendalii*.

Picbauer (R.). **Addenda ad floram Čechoslovakiae mycologicam. Pars VIII.** [Supplements to the mycological flora of Czechoslovakia. Part VIII.]—*Verh. naturf. Ver. Brünn, 1937*, lxix, pp. 29–45, 1938.

Of the large number of records included in this annotated supplement to the mycological flora of Czechoslovakia, the following may be mentioned: *Marssonina moravica* n.sp. [with a Latin diagnosis] forming small, olivaceous-brownish, globose to irregular spots mostly near the leaf tips of *Anemone ranunculoides*; *Peronospora meliloti* on *Melilotus alba*; and *Puccinia arrhenatheri* on barberry foliage.

Ranojević (N.). **Beitrag zur Pilzflora Mazedoniens.** [A contribution to the fungus flora of Macedonia.]—*Hedwigia*, lxxvii, 5–6, pp. 233–242, 1938.

This is an annotated list, collated from the author's posthumous records and prepared for publication by J. Jurišić, of 77 fungi, including a number of pathogens, collected in Macedonia (Bulgaria) between 1904 and 1913.

Zundel (G. L. I.). **The Ustilaginales of South Africa.**—*Bothalia*, iii, 3, pp. 283–330, 1938.

This critically annotated list of 117 Ustilaginales (and four doubtful species) collected or reported from the Union of South Africa and adjacent territories [*R.A.M.*, vi, p. 441] is stated in the author's preface to be a preliminary contribution to a monograph of the group, which it is hoped later to amplify and complete. Some general observations are made on the characterization of the smuts, their classification is discussed in the light of recent studies [all of which have been noticed in this *Review*], and a key to the genera found in the country and host and fungus indexes are furnished. The list contains three new species and a number of new combinations.

Doidge (E[thel] M.). **Some South African Fusaria.**—*Bothalia*, iii, 3, pp. 331–483, 4 pl., 48 figs., 1938.

This preliminary study of the genus *Fusarium* in South Africa is based on about 100 strains isolated in the course of studies on dry root rot of citrus, one of the principal causes of loss in orange orchards, another 300 originating in decaying citrus fruits in storage, and a large number obtained in the ordinary routine of examination or in investigations on wilt diseases of various plants. Altogether some 850 strains were studied, a small percentage of which, chiefly of the *Elegans* section, had to be discarded without identification owing to the difficulty of

securing adequate sporulation. The system of classification established by Wollenweber and Reinking [*R.A.M.*, xv, p. 321] is followed. Very detailed descriptions are given of the morphological and cultural features of the species, and the list is supplemented by keys to the sections and subsections of the genus, fungus and host indexes, and a bibliography of 63 titles.

GADD (C. H.). **Report of the Mycologist for 1937.**—*Bull. Tea Res. Inst. Ceylon* 18, pp. 20–27, 1938.

In 1937, the ratio of dying to apparently healthy but infected tea bushes removed from 13 new areas affected with *Poria* [*hypolateritia*: *R.A.M.*, xvi, p. 634] at St. Coombs, Ceylon, was 1 to 3·7, as against 1 to 2·6 in 1936. Far more diseased bushes are present in any *Poria* patch than is at first apparent, and the removal of dead and sickly bushes only can never completely eradicate infection. The area must be forked through deeply to make certain that no infected roots remain.

The failure to establish tea on old, infected sites has almost always been chiefly due to the presence of old roots in the soil, rather than to active disease on the perimeter of the area. It may, therefore, be possible where the 'piece-meal' method of treatment of diseased bushes on the perimeter is carried out to replant the main area with tea before completion of the treatment at the perimeter.

Further study of tea 'phloem necrosis' [ibid., xvi, p. 635] showed necrosis to be present in the stem cortex, and also in the petiole, midrib, and veins of the leaf, especially in curled leaves. In some cases, pronounced leaf curl was present with marked necrosis in the veins, but no necrosis was found in the root tissues; on other occasions, necrosis was markedly present in the root cortex, but absent from the leaf veins. Diagnosis of the disease remains uncertain until a relatively advanced stage has been reached; the best time for making a diagnosis is probably four or five months after pruning, when affected bushes show very little growth, and this is generally abnormal in character. The disease is so far known to occur only at high elevations, where shortage of food reserves is not a cause of delayed recovery from pruning, such delay in an affected area generally being associated with the disease. Pruning appears to expedite the development of diagnostic symptoms. No pathogenic organism has yet been found, and all attempts to transmit the disease by grafting, root fusions, and the injection of sap from affected plants have been unsuccessful.

The leaf fall of *Grevillea* [*robusta*] associated with a species of *Phyllosticta* [ibid., xvii, p. 205] persisted throughout the year on most estates, being most active after rains. It has now been reported from the Kalutara district and from one estate in the Nawalapitiya area situated at an altitude of 2,000 ft., the highest elevation yet recorded for the disease in Ceylon. Infection is at present confined to rubber-growing areas, not all of which, however, are affected. All the leaves shed during an attack bear irregular, dark, later grey spots; the discoloured area may cover the whole or the greater part of very young leaves. Inoculation tests demonstrated that these spots are due to the fungus, but it is not yet certain that the same organism also causes the leaf fall. The *Phyllosticta* is characterized by dark brown, globose, sometimes

flask-shaped, erumpent pycnidia 116 to 174μ in diameter, with a lighter ostiole, depressed in globose specimens, and measuring 14·5 to 17·4μ in diameter, and oblong, hyaline, non-septate spores with obtuse ends, measuring 3·9 to 6 by 1·8 to 3μ.

Crotalaria usaramoensis and *Tephrosia vogelii* affected by collar rot were found to have been attacked by *Cercosporella theae* [ibid., xvii, p. 138] at ground-level, with resultant death of the whole of the plants above the site of infection. The disease is most likely to occur under conditions which maintain high humidity at the soil-surface.

Manil (P.). **Inactivation partiellement réversible, par $HgCl_2$, du virus appelé 'Tobacco necrosis'.** [The partially reversible inactivation, by $HgCl_2$, of the virus known as 'Tobacco necrosis'.]—*C.R. Soc. Biol., Paris*, cxxviii, 14, pp. 1464–1467, 1938.

Details are given of experiments conducted at the State Agricultural Institute, Gembloux, Belgium, to determine the effect of mercuric chloride on the infectivity of the virus of tobacco necrosis [*R.A.M.*, xvii, p. 562].

Juice from the diseased leaves, after dilution and centrifuging, was treated for one hour with varying concentrations of mercuric chloride, after which the mercury ion was precipitated by a slight excess of ammonium carbonate. Half an hour later the various liquids were diluted 1 in 10 and inoculated into beans [*Phaseolus vulgaris*].

In test No. 1, the infectious juice was distributed in six tubes (5 c.c. in each), one of which was left without further treatment, the second receiving 0·05 c.c. mercuric chloride, the third 0·3 c.c., the fourth 0·3 c.c. with subsequent precipitation of the mercury ion by 0·1 c.c. ammonium carbonate, the fifth as the preceding but using 0·4 c.c. ammonium carbonate, and the sixth consisting of the infectious juice with the admixture of 0·4 c.c. ammonium carbonate. The following numbers of lesions were obtained: (1) 210, (2) 184, (3) 9, (4) 215, (5) 91, (6) 273. In tests Nos. 2 and 3 a similar procedure was followed, but the concentrations of mercuric chloride were increased up to a maximum of 1 c.c. and those of ammonium carbonate to 1·2 c.c. The addition of 0·6 c.c. mercuric chloride reduced the number of lesions on the bean leaves from 330 to 6, with a subsequent rise to 116 after precipitation with 0·4 c.c. ammonium carbonate, while a dose of 1 c.c. entirely counteracted the infective principle and prevented the formation of any lesions in the inoculated plants, the virulence of the juice being partially restored, however, by 1·2 c.c. ammonium carbonate (31 lesions).

Peterson (P. D.) & McKinney (H. H.). **The influence of four mosaic diseases on the plastid pigments and chlorophyllase in Tobacco leaves.**—*Phytopathology*, xxviii, 5, pp. 329–342, 1938.

Using a method based on Willstätter's procedure for determining the chlorophyllase activities of plant tissues (*Plant Physiol.*, v, p. 257, 1930), involving comparisons of the 'green weights' of healthy and mosaic-diseased Wisconsin-Havana tobacco leaves, the writers found that the chlorophyll content of the samples affected by the common, yellow, mild dark green, and mild forms [*R.A.M.*, xvii, p. 631] was consistently lower than that of the sound ones (74·7, 43·3, 87·2, and

72·2 per cent., respectively, as against 100 per cent.). The drop in chlorophyll content in the infected leaves was found to be associated with an approximately proportionate fall in the yellow pigments, carotene and xanthophyll. Except in the case of common mosaic, the chlorophyllase activity of the ground leaf tissues of mosaic plants averaged appreciably higher than that of healthy tobacco (186·9, 118·5, and 125·3 per cent., respectively, for yellow, mild dark green, and mild mosaic as compared with 100 for sound material and 94·3 for that affected by common mosaic). A reduction of 50 per cent. in the chlorophyll content of yellow mosaic plants, as compared with healthy ones, is accompanied by an approximate doubling of the chlorophyllase activity of the ground foliar tissues. The yellow areas were found to be lower in chlorophyll but higher in chlorophyllase activity than the green ones. The chlorophyllase activity of healthy leaf tissues was found to be directly proportional to chlorophyll content, and the same was the case, though in a different ratio, with the leaf, stem, and root tissues of yellow mosaic plants.

Frampton (V. L.) & Neurath (H.). **An estimate of the relative dimensions and diffusion constant of the Tobacco mosaic virus protein.**—*Science*, N.S., lxxxvii, 2264, pp. 468–469, 1938.

The viscosity of solutions of the tobacco mosaic virus protein is stated to be proportional to the concentration of the virus up to concentrations of 1 per cent. Assuming the shape of a prolate spheroid for the virus protein particle a partial specific volume of 646, a particle weight of 17,000,000, a density of 1·55, and neglecting the factor of hydration, the authors used the Kühn equation in their calculations and obtained the value of 36·8 for the ratio of the long to short axis of the virus protein particle and the values of $3{\cdot}4 \times 10^{-7}$ and $1{\cdot}98 \times 10^{-5}$ cm. for the semi-minor and the semi-major axes of the particles, respectively. The diffusion constant of the virus was calculated from the viscosity data to have the value of $4{\cdot}5 \times 10^{-8}$, and the close agreement between the observed and calculated diffusion constants indicates that the protein is relatively hydrophobic.

Lauffer (M. A.). **The molecular weight and shape of Tobacco mosaic virus protein.**—*Science*, N.S., lxxxvii, 2264, pp. 469–470, 1938.

By means of a high precision quartz viscometer the viscosities of very dilute aqueous solutions of tobacco mosaic virus protein were determined and the viscosity was found to be a linear function of concentration up to a concentration of 0·1 per cent. but the linearity does not hold for concentrations of 1 per cent. [see preceding abstract]. Calculating on the basis of Kühn's equation and assuming little or no hydration, the author obtained the value of 35·0 for the ratio of length to diameter of the cylindrical rod-shaped particles of the virus protein. A value of about $42{\cdot}5 \times 10^{6}$ was found for the molecular weight of the protein, corresponding to a particle $12{\cdot}3\mu\mu$ in diameter and $430\mu\mu$ in length. It is emphasized that a better knowledge of the shape and state of hydration of the protein is necessary in order to interpret accurately the data from the ultracentrifuge.

Holmes (F. O.). **Inheritance of resistance to Tobacco-mosaic disease in Browallia.**—*Phytopathology*, xxviii, 5, pp. 363–369, 2 figs., 1938.

Morphologically identical plants of *Browallia speciosa* var. *major* were found to fall into two categories closely resembling those already observed in *Capsicum frutescens* in respect of their reaction to infection by the tobacco mosaic virus [*R.A.M.*, xvi, pp. 711, 766], some permitting the systemic spread of the virus while others effectively localized it in the inoculated leaves. The systemic form of the disease was characterized in the early stages by chlorosis and retardation of growth, and subsequently by foliar and flower mottling and distortion. The localization of the infective principle in or near necrotic primary lesions was followed by the abscission of all the diseased leaves. Necrotic-type plants were found to possess a dominant gene N in a homozygous (NN) or heterozygous (Nn) condition, which was responsible for the development of the localized type of infection and did not occur in the plants affected by chlorosis (nn). The homozygous necrotic-type plants constitute a sub-variety capable of prompt recovery from tobacco mosaic, even after repeated inoculation.

Rischkov [Ryjkoff] (V. L.) & Gromyko (E.P.). **A new method for the purification of the Tobacco mosaic virus.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xix, 3, pp. 203–205, 1938.

An account is given of a method which is claimed to allow of obtaining crystalline preparations of the virus of common tobacco mosaic much more rapidly than that of Loring and Stanley [*R.A.M.*, xvi, p. 498]. Briefly outlined, the method consists in freezing leaf and stalk material from diseased tobacco or tomato plants, after which it is twice extracted with a 0·1 molar solution of disodium hydrogen phosphate; the juice thus obtained is filtered through filter paper, and 1·5 to 2 gm. of sodium benzoate is added to 100 c.c. of the filtered juice. After thorough mixing normal hydrochloric acid is added until flakes of benzoic acid begin to appear. The precipitate is filtered and redissolved in a 0·1 molar solution of disodium hydrogen phosphate, and the resulting liquid is purified of pigments with carbolen (activated charcoal) without any considerable loss of the virus. This treatment yields a clear or slightly yellowish, opalescent liquid, from which the virus is crystallized by Stanley's method. To obtain permanent microscopic preparations a drop of the suspension of crystals in ammonium sulphate solution is spread on a glass slide and dried, fixed with a concentrated alcoholic solution of picric acid, carefully washed in water, stained with acid fuchsin, and mounted in Canada balsam. Inoculations with the crystalline material suspended in ammonium sulphate at a dilution of 1 in 100,000 produced a considerable number of necroses on *Nicotiana glutinosa* leaves.

Brain (C. K.). **Report of the Tobacco Research Board for the year ending December 31st, 1937.**—*Rhod. agric. J.*, xxxv, 5, pp. 350–378, 1938.

In the section of this report dealing with tobacco breeding (by A. A. Moffett) it is stated that when the tobacco varieties and hybrids

White Stem Orinoco, Jamaica Wrapper, Ambalema, Ambalema × White Stem Orinoco, and Ambalema × Jamaica Wrapper, planted in separate plots in several randomized blocks, were inoculated with mosaic [*R.A.M.*, xv, p. 704], Ambalema showed no infection, not even the slightest mottling, White Stem Orinoco and Jamaica Wrapper showed 100 per cent. infection and a very great decrease in yield, and the two F_1 hybrids showed 100 per cent. infection, but the plants grew out of the primary symptoms, became robust later on, and much of the mottling disappeared as the plants reached maturity. The leaf of the hybrids had a greenish cast similar to that of Ambalema but was much nearer to their other parents as regards body and texture.

TERNOVSKY (M. F.) & KHUDYNA (I. P.). Отношение гибридов **Nicotiana glutinosa L. × N. tabacum L.** к. обычной Табачной мозаике. Предварительное сообщение. [Reaction of *Nicotiana glutinosa* L. × *N. tabacum* L. hybrids to ordinary Tobacco mosaic. Preliminary report.]—*Всесоюзн. научно-исслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна* (*ВИТИМ*) [*The A.I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], Krasnodar, *Publ.* 135, pp. 69–70, 1938.

The annual losses from tobacco mosaic in the Azoff-Black Sea region are stated to amount to 3 to 5 per cent. In resistance trials in 1935 and 1936 no variety of *Nicotiana tabacum* was found to be immune from mosaic, but *N. glutinosa* developed necrotic lesions only in the region of inoculation (localized infection) and its leaves remained healthy and did not contain the virus. In breeding against tobacco mosaic [*R.A.M.*, xvii, p. 417 and next abstract] Ternovsky succeeded in 1932 in obtaining amphidiploids from the cross *N. glutinosa* × *N. tabacum* with 2 genoms of *N. glutinosa* (24 chromosomes) and 2 genoms of *N. tabacum* (48 chromosomes). Back-crossing to *N. glutinosa* produced a sesquidiploid with 2 genoms of *N. glutinosa* and 1 genom of *N. tabacum;* back-crossing to *N. tabacum* produced a sesquidiploid with 2 genoms of *N. tabacum* and 1 genom of *N. glutinosa*.

Inoculation experiments showed that in the first generation hybrids both sesquidiploids exhibited only local infection; the second generation from the sesquidiploid with 2 genoms of *N. tabacum* segregated in the number of chromosomes and in resistance to mosaic, the majority of the plants showing general infection; in the third generation from the sesquidiploid with 2 genoms of *N. tabacum,* 10 out of 19 examined families were found to contain resistant plants, one of these lines showing 50 per cent. plants with local infection.

TERNOVSKY (M. F.). Наследственность локализации мозаики у гибридов **Nicotiana glutinosa L. × N. tabacum L.**—[Inheritance of mosaic localization in *Nicotiana glutinosa* L. × *N. tabacum* L. hybrids.]—*Всесоюзн. научно-исслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна* (*ВИТИМ*). [*The A.I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], Krasnodar, *Publ.* 135, pp. 71–74, 1938. [English summary.]

Two years' study on the susceptibility of *Nicotiana glutinosa* × *N. tabacum* hybrids to mosaic [see preceding abstract] showed that the

gene which determines the localization of the virus in *N. glutinosa* resulting in the necrotic type of lesion only, is dominant in the F_1 (amphidiploid), in the sesquidiploid with 2 genoms of *N. glutinosa* and 1 genom of *N. tabacum*, and in the sesquidiploid with 1 genom of *N. glutinosa* and 2 genoms of *N. tabacum*. The back-crosses of the sesquidiploid containing 1 genom of *N. glutinosa* and 2 genoms of *N. tabacum* with *N. tabacum*, and the second generation of this sesquidiploid do not follow the Mendelian method of segregation, apparently owing to the polyploidy of the organism and the elimination of gametes and zygotes as a result of an irregular meiosis. In the F_3 generation 5 out of 29 families showed a regular monohybrid segregation and in the F_4 gave 27 constant and 56 segregating progenies; in another set of F_3 families 19 out of 26 showed a continuous segregation and this persisted in the F_4. The 33 constant progenies obtained in the F_4 and F_5 differ but slightly from the tobacco parent Dubek 44/39, have regular meiosis, possess the normal number of 48 chromosomes for tobacco, and are being further studied.

Grushevoy [Grooshevoy] (S. E.). Болезни Табака и Махорки. [Diseases of Tobacco and Indian Tobacco.]—*Всесоюзн. научно-исслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна (ВИТИМ).* [*The A.I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind. (VITIM)*], Krasnodar, *Publ.* 136, 144 pp., 41 figs., 1938.

This is a general text-book on the fungous, bacterial, virus, and physiological diseases of tobacco and Indian tobacco (*Nicotiana rustica*), the occurrence, economic importance, symptoms, control measures, and other aspects of the various diseases being discussed in some detail.

Levykh (P. M.). Методика определения зараженности почвы хламидоспорами **Thielaviopsis basicola (Berk.) Ferraris.** [Methods for determining the degree of soil infestation with chlamydospores of *Thielaviopsis basicola* (Berk.) Ferraris.]—*Всесоюзн. научно-исслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна (ВИТИМ).* [*The A.I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind. (VITIM)*], Krasnodar, *Publ.* 135, pp. 13–22, 1938. [English summary.]

In rearing healthy tobacco seedlings the selection of soil free from spores of *Thielaviopsis basicola* [*R.A.M.*, xvii, p. 491] is thought to be preferable to sterilization of the soil, which is not always reliably carried out. The author therefore devised a method of estimating the number of chlamydospores of *T. basicola* in soil. It was found that repeated washing and centrifuging of soil samples, artificially infected with a known number of chlamydospores separated up to 92·5 per cent. of the chlamydospores present in the sample and revealed the presence of even 10 chlamydospores per c.c. of soil. In a series of pot experiments it was shown that the presence of less than 100 chlamydospores per c.c. of artificially infected soil resulted in very little infection among the seedlings and did not reduce the amount of plants suitable for transplantation; 100 to 1,000 chlamydospores per c.c. of soil resulted in only slight infection of adult tobacco, 3,312 caused severe infection, and

5,780 induced the maximum amount, which did not further increase with an increase of chlamydospores. It is thought that the method would be quite suitable for use in practice.

GRUSHEVOY [GROOSHEVOY] (S. E.). Меры борьбы с рассадной гнилью Табачной и Махорочной рассады. [Measures for controlling damping-off of Tobacco and Indian Tobacco seedlings.]—*Всесоюзн. научно-исслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна* (*ВИТИМ*). [*The A.I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], Krasnodar, *Publ.* 135, pp. 4–12, 1938. [English summary.]

Damping-off of tobacco and Indian tobacco [*Nicotiana rustica*] seedlings in all tobacco-growing districts of the U.S.S.R. is stated to be mainly caused by *Rhizoctonia* sp. (*Moniliopsis aderholdi*) [*R.A.M.*, xv, p. 61] and sometimes, especially in beds of very young seedlings, by *Pythium de Baryanum* [loc. cit.]. *M. aderholdi* [ibid., xvii, p. 183] was found in 1937 in the Azoff-Black Sea region also to attack the roots of the seedlings. Experiments in which sclerotia of *M. aderholdi* were put into the soil at different depths showed that the mycelium of this fungus was able to reach the surface of the soil from 80 per cent. of sclerotia buried at a depth of 0·5 cm., from 44·5 per cent. at a depth of 2 cm., and from none at a depth of 5 cm. Pot experiments showed, however, that the fungus was capable of causing infection of the seedlings, though in a considerably less degree, from a depth of about 10 cm. Apparently the mycelium grew upwards through the soil till it met the roots of the seedlings and, except in periods of relatively low temperatures, could then reach the stem, causing damping-off. Of all the fungicides tested in both field and laboratory trials spraying with 1 per cent. Bordeaux mixture gave the best control against both *M. aderholdi* and *P. de Baryanum*, while dusting with flowers of sulphur diluted with four parts of sand was only effective against the former. According to experimental results obtained in 1936, the application of Bordeaux mixture increased the production of Indian tobacco seedlings suitable for transplanting 2·8 times, and dusting with flowers of sulphur 2·4 times. It is concluded that complete disease control would result from filling the seed-beds with a layer of sterilized soil, at least 10 cm. thick, spraying with 1 per cent. Bordeaux mixture at the appearance of the first pair of true leaves or earlier and thereafter at 5-day intervals, destroying old sources of infection, and securing good ventilation of the seed-beds.

GRUSHEVOY [GROOSHEVOY] (S. E.) & KHUDYNA (I. P.). Оздоровление семенного материяла Табака. [Disinfection of Tobacco seed.]—*Всесоюзн. научно-исслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна* (*ВИТИМ*). [*The A.I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], Krasnodar, *Publ.* 135, pp. 31–48, 1938. [English summary.]

The results of experiments described in this paper, carried out by phytopathologists of the State Institute for Tobacco from 1935 to 1937, led to the following conclusions. The longer seeds of tobacco are stored the less they are contaminated with pathogenic bacteria or fungi; this observation did not, however, apply to virus diseases, nor did the

selection of seeds from apparently healthy plants guarantee virus-free seed in all varieties of tobacco. It is, therefore, essential to disinfect the seeds against virus diseases. Heating for 30 to 60 mins. at a temperature of 85° to 95° C. reduced the percentage of white spot [believed to be caused by a virus: *R.A.M.*, x, p. 346] by nearly half. *Bacterium tabacum* in dry diseased leaves lost its virulence almost entirely when heated for one hour at 85° to 90° and entirely at 95°. Seeds were freed from *Fusarium* sp. and *Alternaria tenuis* [ibid., xvi, p. 344] when heated for one hour at 85° to 95°. Seeds which had a water content of less than 6·5 per cent. prior to heat treatment showed the least reduction of germination. It is recommended to heat the seed, after preliminary drying, either in a layer 1 cm. thick, or in small bags of 100, 200, and 500 gm. Gradual warming of the seeds was less deleterious than rapid. Heating in bags of 100 or 200 gm. at 100° or in bags of 500 gm. at 90° C. did not impair germination, neither did storing the heated seed for one year. Of the fungicides tested the formalin solution at the rate of 1 in 50 for 10 mins. freed tobacco and Indian tobacco [*Nicotiana rustica*] seeds from the causal agents of bacterial leaf spot 'ryaboukha' [chiefly *Bact. tabacum*: ibid., xv, p. 749], and the Soviet-made germisan in a 1 to 3 per cent. solution controlled *Bact. tabacum* and the seed-borne fungi *Alternaria* and *Fusarium* spp. After treatment with germisan the seeds should be thoroughly washed, well dried, and sown.

MUNCIE (J. H.) & KEN KNIGHT (G.). **Tomato spraying trials.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xx, 4, pp. 247–250, 1938.

In a comparative spraying test carried out in Michigan in 1936 to ascertain to what extent materials likely to control *Septoria lycopersici* [*R.A.M.*, xvii, pp. 81, 140] depressed the yield of tomatoes as compared with Bordeaux mixture, Marglobe tomatoes sprayed four times at the rate of 300 gals. per acre per application with Bordeaux mixture (4–6–100), oxo bordo (6–100), coposil (2–100), and cuprocide (2–100, plus 4 oz. spreader) yielded, respectively, 3·64, 4·05, 5·08, and 5·08 tons per acre, as compared with 5·9 tons per acre for the unsprayed controls, the corresponding figures for the variety Pritchard being 6·07, 6·08, 7·66, and 5·57 tons, with 6·52 tons in the controls, and for the variety John Baer 4·57, 5, 5·52, and 6 tons, with 6·21 tons in the unsprayed controls. *S. lycopersici* was not seen on the control plants until 10th September and the crop was harvested between 10th August and 22nd September.

In a similar test in 1937, five applications of the same materials (4 oz. spreader used with the coposil) made to the variety Pritchard gave, respectively, yields of 21·71, 25·55, 23·45, and 24·42 tons per acre, with 28·58 tons per acre for the unsprayed controls, the corresponding figures for estimated defoliation due to infection by *S. lycopersici* and early blight [*Alternaria solani*: ibid., xvi, p. 419 *et passim*] being 25, 25, 35, and 5 per cent., with 40 per cent. in the controls.

The best protection against infection was thus given by the cuprocide plus spreader, but the fungicidal value of the new sprays under conditions of severe infection remains as yet unknown, and for the present growers are advised to continue spraying with Bordeaux mixture.

CRANDALL (B. S.) & HARTLEY (C.). **Phytophthora cactorum associated with seedling diseases in forest nurseries.**—*Phytopathology*, xxviii, 5, pp. 358–360, 1938.

Phytophthora cactorum [*R.A.M.*, xvii, p. 584, and above, p. 681] appears from observations by the writers and others in the United States to be the cause, not only of damping-off of conifers, but also of die-back and canker of various broad-leaved trees. In unpublished communications to the authors, C. May reports the isolation of the fungus from European beech seedlings showing top wilt symptoms in Ohio, and R. Swingle its occurrence on tulip poplar [*Liriodendron tulipifera*] seedlings with typical sore shin in the same State. Walnut (*Juglans nigra*) seedlings in a North Carolina nursery developed a sudden destructive wilt, which was shown by cultural studies and inoculation experiments to be due to *P. cactorum*. The same organism was further found to be responsible for a disease involving softening of the leaves and upper stems of *Nyssa sylvatica*, *Colutea arborescens*, and *Caragana arborescens* seedlings in a Missouri nursery, causing estimated losses of 80, 25, and 100 per cent., respectively. Similar attacks, also presumably due to *P. cactorum*, occurred on species of *Cornus*, *Robinia*, *Acer*, *Prunus*, and *Ostrya* in the same nursery. A collar rot of four-week-old seedlings in a Maryland nursery was found to be caused by *Phytophthora cactorum*, which is also a weak pathogen of *Pinus resinosa*, mostly on heavy soils under abnormally humid conditions. In comparative inoculation tests on three-year-old seedlings of this species, 15 out of 16 were killed by the so-called *Phytophthora pini* [included by Tucker under *P. cactorum*: ibid., x, p. 755] from *Pinus resinosa*, while none of the ten inoculated with *Phytophthora cactorum* from *N. sylvatica*, *Colutea arborescens*, *Caragana arborescens*, and *Pinus nigra* suffered any ill effects.

HOPP (H.). **Sporophore formation by Fomes applanatus in culture.**—*Phytopathology*, xxviii, 5, pp. 356–358, 1 fig., 1938.

A strain of *Fomes applanatus* [*Ganoderma applanatum*] isolated from the context of a sporophore on a fallen beech (*Fagus grandifolia*) [*R.A.M.*, xii, p. 544] log in New York State produced no fructifications during four years' culture on malt agar, but on transference to sterilized poplar (*Populus canadensis* var. *eugenei*) [ibid., xiii, p. 604] blocks, maintained under controlled conditions at 28° C. at varying percentages of relative humidity in special humidity chambers described elsewhere (*Bot. Gaz.*, xcviii, p. 25, 1936), 14 sporophores developed on 11 out of 30 blocks in one to three weeks. Ten of these fruit bodies were atypical in so far as they either lacked a normal pileus or did not tend in a vertical direction; the four normal ones were formed on the vertical sides of blocks exposed to 75 per cent. relative humidity and ultimately attained a length of 2 to 3 cm. This is believed to be the first record of the formation of typical *G. applanatum* sporophores in culture. Evidently the necessary environmental conditions for the process include exposure of the surface mycelium to ventilation with air of normal oxygen concentration; sufficient moisture supply to the mycelium within the substratum; and continuous but moderate desiccation of

the surface mycelium by exposure of the wood block to moist but not saturated air.

Birch (T. T. C.). **Armillaria mellea (Vahl.) Quél. in relation to New Zealand forests.**—*Rep. Aust. N.Z. Ass. Sci.*, xxiii, pp. 276–279, 1937. [Received July, 1938.]

Armillaria mellea is stated to occur in many of the indigenous forest soils in New Zealand, where it was found to be responsible for heart rot in a heavily overstocked stand of sapling silver beech (*Nothofagus menziesii*), a white pocket rot of sawn timber of the same host, and root rot of various exotic conifers [*R.A.M.*, xiii, p. 553], including *Pinus radiata*, *P. ponderosa*, *P. laricio* [*P. nigra*], *P. murrayana*, and to a slighter extent *Chamaecyparis lawsoniana*. A debilitated condition, induced either by faulty planting or an adverse environment, appeared to be a decisive predisposing factor in all the cases of *Armillaria* root rot observed.

Van Vloten (H.). **Een ziekte van den Douglasspar, (waarschijnlijk) veroorzaakt door Phaeocryptopus gaeumanni (Rohde) Pet. [Adelopus gaeumanni Rohde].** [A Douglas Fir disease (probably) caused by *Phaeocryptopus gaeumanni* (Rohde) Pet. (*Adelopus gaeumanni* Rohde).]—*Ned. Boschb.-Tijdschr.*, xi, 5, pp. 196–204, 3 figs., 1938.

A summary is given of the available knowledge concerning the Douglas fir (*Pseudotsuga douglasii* and *P. glauca*) [*P. taxifolia*] disease caused by *Phaeocryptopus gaeumanni* (Rohde) Pet. [*R.A.M.*, xvii, p. 638] in Switzerland, Germany, and Austria followed by a report of the conclusions—confirmatory of those already published by von Gaisberg and Rohde [ibid., xvii, p. 84, *et passim*]—reached by the members (Frl. v. Gaisberg, E. Munch, J. Liese, T. Rohde, and the author) of a study tour through the infected stands of south Germany from 21st to 23rd March, 1938.

Peace (T. R.). **Butt rot of conifers in Great Britain.**—*Quart. J. For.*, xxxii, 2, pp. 81–104, 1938.

A survey made in about 250 woods in Great Britain where felling or thinning of conifers was in progress or had recently taken place, showed that butt rot [*R.A.M.*, xiv, p. 803] was most prevalent on larch but was nearly as bad on spruce [*Picea abies*] and Douglas fir [*Pseudotsuga taxifolia*], whereas all the pines examined appeared to be remarkably resistant up to the ages of 60 or 70 years, and silver fir [*Abies alba*] to be even less affected. The evidence suggested that *Thuja plicata* is likely to suffer considerably, and that *T. heterophylla* and Lawson's cypress [*Cupressus lawsoniana*] are certainly more susceptible than pines.

By far the most important causal agent was *Fomes annosus* [ibid., xvii, p. 361], which was responsible for the rot on 2,534 out of 3,195 affected trees examined; it occurred on most of the species under observation, and nearly as often on young trees as on old ones. *Polyporus schweinitzii* [ibid., xvii, p. 359] was the second most frequent cause of butt rot, being found on 58 trees (larch, Norway spruce, Sitka spruce [*Picea sitchensis*], Scots pine [*Pinus sylvestris*], and Douglas

fir); it is a rot of middle age and maturity, attacking chiefly trees 50 years old or more. *Armillaria mellea* was observed on 42 trees, representing a wide range of species. *Merulius himantioides* [ibid., viii, p. 280] was associated with a dark brown cubical rot of 17 European larch trees in two localities. *Hypholoma fasciculare* [ibid., xvi, p. 75] occurred on 9 trees of European larch, an unidentified larch, Sitka spruce, and *T. plicata*, generally causing a soft brown rot. Other fungi found included *Clitocybe* sp. on European larch, *Polyporus destructor* [ibid., xvi, p. 221] causing a cubical orange brown rot in European larch, *Lenzites sepiaria* [ibid., xvii, pp. 4, 215] causing a soft brown rot in Scots pine, *Stereum sanguinolentum* [ibid., xvii, p. 362] causing staining and a soft brown or streaked rot in European larch, *Coniophora cerebella* [*C. puteana*: ibid., xvii, pp. 424, 496, 640] causing a dark brown cubical rot in European larch, *C.* sp. on Norway spruce, a species of *Polyporus* or *Poria* on Scots pine, *Stereum* sp. on European larch and Norway spruce, *C. bourdotii* on Douglas fir, *F. igniarius* [var.] *robustus* causing red staining in Japanese larch [*Larix leptolepis*], and *Pholiota squarrosa* [ibid., xvi, p. 822] producing a soft brown rot in Norway spruce.

Rot was particularly heavy on land previously ploughed and sometimes on land that had carried a forest crop before, but was not present to any large extent on lands that had previously been moor or pasture. Larch was most affected at low altitudes. There was evidence that in all conifers an eastern aspect reduces rot. In spruce, rot was most prevalent on clay and least on sandy soils, while with larch the reverse obtained. Larch was very seriously affected in badly drained localities, but spruce showed less rot in badly drained than in well drained situations. In larch, the greatest amount of rot was found in areas where the rainfall was low. Spruce and some other conifers showed more rot when planted with hardwoods than when planted with other conifers or alone.

Control (in so far as it is practicable) consists in the careful selection of suitable species in areas known to be liable to rot. Once a crop has been planted, the amount of rot present in the thinnings should be noted, in order that the crop can be realized before becoming unsaleable.

Edson (H. A.). **United States of America: bark canker of Monterey Cypress.**—*Int. Bull. Pl. Prot.*, xii, 5, p. 98, 1938.

A new destructive disease of the Monterey cypress (*Cupressus macrocarpa*) termed cypress bark canker, attributed to the fungus *Coryneum cardinalis* Wagener by W. W. Wagener [*R.A.M.*, vii, p. 754], is reported to have spread over two-thirds of California, though it has not yet appeared in the only two existing natural stands of this tree on Point Lobos and Cypress Point on the Monterey Peninsula, within a few miles of severely infected windbreak and ornamental plantings. It has also been found in a less virulent form on introduced Italian cypress [*C. sempervirens*]. According to experimental tests other related conifers may be susceptible to the disease, although so far no infection has been observed in the open. Every attempt is being made to check the spread of the disease.

Richards (Audrey C.). **Defects in cross ties, caused by fungi.**—*Cross Tie Bull.*, xix, 3, pp. 1–31, 17 figs., 1938.

This is a semi-popular summary of the information at present available on the fungal rots of railway sleepers in the United States [*R.A.M.*, xvii, p. 4 *et passim*] based largely on the writer's extensive experience in the examination of decayed material at the Forest Products Research Laboratory, Madison, Wisconsin.

Ascu—a wood preservative.—*Indian For. Rec.*, N.S., *Utilization*, i, 6, pp. 143–187, 1 pl., 4 diags., 1938.

A detailed account, preceded by a foreword by H. Trotter, Utilization Officer at the Forest Research Institute, Dehra Dun, is given of experiments in India on the ascu process of timber preservation, with full directions for the application of this very promising form of treatment [*R.A.M.*, xvii, p. 278].

Ogilvie (L.) & Hickman (C. J.). **Progress report on vegetable diseases. IX.**—*Rep. agric. hort. Res. Sta. Bristol, 1937*, pp. 96–109, [1938].

Asparagus rust [*Puccinia asparagi*: *R.A.M.*, xiii, p. 212; xvii, p. 581], last reported near Evesham in 1933, occurred to a slight extent in nearly every field of this crop in the Vale of Evesham in 1937, favoured, apparently, by hot, dry weather with heavy dews in August and September. Control consists in an early, thorough cutting and burning of the bower, with thorough cutting of the buds in spring. When maiden plants are attacked, as at Evesham, the seedling-beds should be isolated from the main plantings. The latter should be in moderately exposed situations, not bounded by hedges or trees, and with the rows parallel to the direction of the wind.

Halo blight (*Bacterium medicaginis* var. *phaseolicola*) [ibid., xvii, pp. 578, 585] incidence on dwarf beans [*Phaseolus vulgaris*] ranged from 0 to 13 per cent. on the pods of 67 varieties tested, this figure not being closely correlated with the number of plants infected. The valuable early variety, Prince, was resistant [ibid., xvi, p. 85], as was Peerless. Varietal susceptibility and resistance may frequently be estimated from the seed colour alone. The comparative resistance of the Abundant, Black Prince, Black Wonder, Ne Plus Ultra, Superlative, and Unrivalled varieties was confirmed. Pod infection by mosaic [ibid., xvii, p. 369] amounted to over 30 per cent. Varieties with dark green foliage were less affected by leaf symptoms than others. Seed of the variety William's Earliest of All was heavily infected with mosaic and gave 44 and 94 per cent. infection on 20th July and 18th August, respectively. Locally, the disease appears to be chiefly due to common bean mosaic (*Phaseolus* virus 1) [see above, p. 646]. The symptoms are severe leaf-mottling and blistering, with downward curling of the edges; the plants and leaves may be small, and the pods are distorted, rough, and sometimes warted. The Princess and Hundred for One bean varieties again remained free from anthracnose (*Colletotrichum lindemuthianum*) [ibid., xvii, p. 574], the following also being unaffected: Selected Canadian Wonder (Sutton), Foremost, Magpie, Leicester Wonder, Abundance, and Emperor William.

The Passion group of winter lettuces showed marked winter hardiness

and resistance to *Botrytis* [*cinerea*: ibid., xvii, p. 6], while the subgroup, Stanstead Park, averaged 71 and 52 per cent. survival in two tests, respectively.

Onion white rot (*Sclerotium cepivorum*) [ibid., xiii, p. 614] is widely distributed in the Bristol province, mainly on White Lisbon spring onions. It is occasionally epidemic, and in 1937 destroyed whole fields of this variety, though in one case onions had not been planted for eight years. A soil application in two localities of a proprietary organic mercury compound in dust form, stated to contain hydroxymercuri-chlorophenol with 20 per cent. organically combined mercury, before sowing White Lisbon onions, and made at the rate of 1 oz. per sq. yd. of soil surface, gave 56·8 and 17·9 per cent. infection for the two localities, respectively, as against averages of 86·7 and 90·4 per cent. for the corresponding untreated control plots (four in each area).

KLEMM (M.). **Die wichtigsten Krankheiten und Schädlinge an Raps und Rübsen.** [The most important diseases and pests of Colza and Rape.]—*Dtsch. landw. Pr.*, lxv, 19, p. 239; 20, pp. 251–252, 9 figs., 1 map, 1938.

Semi-popular notes are given on the following diseases contributing to the reduction of the colza [*Brassica napus*] and rape [*B. rapa oleifera*] yields in Germany; root rot (*Pythium de Baryanum* and other soil-inhabiting fungi), club root (*Plasmodiophora brassicae*) [*R.A.M.*, xvi, p. 509], black rot (*Pseudomonas campestris*), mosaic [ibid., xvi, p. 10], canker (*Sclerotinia sclerotiorum*) and a destructive black spotting of the stems, petioles, and siliquae due to *Alternaria brassicae*, which was responsible for losses amounting to 75 per cent. of the crop in eastern Schleswig-Holstein in 1935 and caused appreciable damage elsewhere. White rust (*Cystopus candidus*) [ibid., xiv, p. 2], downy mildew (*Peronospora parasitica*) [ibid., xiv, p. 1], and true mildew (*Erysiphe communis*) are of less frequent occurrence and have not so far caused substantial injury.

HARTMAN (J. D.). **Boron deficiency of Cauliflower and Spinach on Long Island.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 518–525, 4 figs., 1938.

In further investigations into cauliflower browning in New York State [*R.A.M.*, xvi, p. 722; xvii, p. 496] two crops of Improved Holland Erfurt cauliflowers and two of Reselected Savoy spinach were grown in the greenhouse in boxes of surface soil from an affected cauliflower field on Long Island. Before planting each crop of cauliflower and the second crop of spinach, borax was added to three boxes in amounts of 0·1, 1·6, and 0·08 gm., respectively; ample quantities of fertilizers were supplied to all plants. In the first cauliflower experiment only two heads showed external browning of the type always accompanied by internal brown spotting, but in the second experiment all the heads in the boxes without borax showed the condition, one head developing mild hollow stem. No symptoms appeared in the borax-treated boxes. The spinach plants grown without boron, especially those of the second crop, had small, deformed leaves, and many of the plants turned yellow and died, whereas most of the plants supplied with borax grew normally.

In a field test with two rows of Danamerica and two of Improved Holland Erfurt cauliflowers, one row of each receiving about 5 lb. borax per acre, the borax application significantly reduced the amount of internal brown spotting in all cases except that of the Danamerica variety at P_H 6 to 7·1. The rate of application appeared to be too low to eliminate the condition completely. Injury from boron deficiency was more severe in soils at P_H 4·7 to 5 than at P_H 6 to 7·1. In a further experiment, a borax application of 25 lb. per acre eliminated hollow stem almost completely from Improved Holland Erfurt plants, but had little effect on yield.

It is concluded that boron is apparently deficient in a number of soils on Long Island, but not sufficiently so to cause appreciable injury to cauliflowers every year, regardless of soil and weather conditions. The chief symptom of boron deficiency in cauliflowers is internal brown spotting with or without surface discoloration of the head, and hollow stem.

Raleigh (G. J.) & Raymond (C. B.). **A preliminary note on the control of internal breakdown in table Beets by the use of boron.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 526–529, 1938.

For several years table beets grown in Ontario County, New York, have been affected by a physiological breakdown, known as 'girdle', characterized by dark, sunken spots which may partially encircle the beets usually at or slightly below soil-level. The trouble, which does not resemble closely the common crown rot and dry rot of sugar beets and of mangolds, has usually been attributed to drought, and generally occurs in fields where no effort has been made to maintain the organic matter content of the soil.

In pot tests in the greenhouse beet seeds were grown in soil from a severely affected field, given 5–10–5 fertilizer and various minor elements (one pot excepted). Half the pots in each treatment were watered normally (wet series) and half, after 18th May, were allowed to become dry before being watered (dry series). The results obtained showed that the borax treatment gave the best result [*R.A.M.*, xvii, p. 574] with 64 and 46 per cent. breakdown for the dry and wet treatments, respectively, as against 91 to 82 per cent. for the control; the affected plants in the borax-treated series, moreover, were but slightly injured. In a test in the spring of 1937, applications of borax at the rate of 5 lb. per acre made to a field in some parts of which injury was severe, gave 94 per cent. beets free from injury, 3 per cent. with slight internal injury, and 3 per cent. severe breakdown, the corresponding figures for two control areas being 4, 10, and 86, and 20, 30, and 50, respectively. Applications of manganese, ferrous copper, or zinc sulphates were ineffective.

Owen (F. V.) et al. **Curly-top resistant varieties.**—*Proc. Amer. Soc. Sug. Beet Technol., 1938*, pp. 91–94, 1938. [Abs. in *Facts ab. Sug.*, xxxiii, 8, p. 35, 1938.

Sugar beet-growing districts of the United States subject to curly top [*R.A.M.*, xvii, p. 497] are likely to depend on seed from the U.S. varieties 33 and 12 for the next two years or longer. Of the two, the

former gives higher sugar yields and is probably generally superior where the disease is not a serious factor, but 12 is more resistant to curly top and its production is usually reasonably good. In a test at Buhl, Idaho, five new strains (temporarily designated 610, 611, 612, 622, and 623) proved highly resistant to curly top, being roughly comparable to 12 in this respect.

NAGEL (C. M.). **The longevity of Cercospora beticola in soil.**—*Phytopathology*, xxviii, 5, pp. 342–350, 1938.

In addition to information already presented [*R.A.M.*, xv, p. 550] in connexion with studies on the relationship of soil infestation by *Cercospora beticola* [see above, p. 656] to the initiation of beet leaf-spot epidemics in Iowa, the author found that the fungus maintains its viability and pathogenicity in sterile soil cultures for 27 months and, throughout a temperature range of —27·8° to 15·5° C. In naturally infected field soil it remained pathogenic to beet for at least 20 months, but the amount of inoculum was much diminished. No correlation could be detected between the hydrogen-ion concentration of the soil and the extent of mycelial development in these experiments, but an abundance of organic matter was found to favour the growth of the fungus. Sugar beets grown a second year on a field severely infected with *C. beticola* in the preceding season contracted leaf spot in a destructive form, whereas relatively little infection occurred on adjacent land not used for beet cultivation for several seasons previous to the tests. The sucrose percentages and acre yields of the former crop (9·6 per cent. and 13·9 tons) were markedly depressed as compared with those of the latter (12·2 per cent. and 23·9 tons).

DOERELL (E. G.). **'The minor elements'—die Spurenelemente und ihre Bedeutung für das Pflanzenleben.** [The minor elements and their significance in plant life.]—*Z. Zuckerindustr. čsl. Repub.*, lxii, 31, pp. 246–247, 1938.

In connexion with a semi-theoretical discussion of the significance of the minor elements in plant growth, with special reference to boron [*R.A.M.*, xvii, pp. 195, 343, 477 *et passim*], the writer briefly summarizes some recent information on the use of this substance for the control of heart and dry rot of sugar beets in Czechoslovakia and Germany [ibid., xv, p. 338; xvii, p. 574]. That the water-soluble borates are particularly well adapted for this purpose is beyond a doubt, while there is also no question that the most efficacious rate of application is 13 to 20 kg. borax per hect., corresponding to 10 to 13 kg. boric acid. Superphosphate has proved specially valuable both as a distributor and in the provision of nutrient material, since its free phosphoric acid content affords a guarantee of solubility of the borates or boracites. In 1937 the German Reich Food Board, according to a report by C. Krügel *et al.* in Tagung der Landwirtschaftschemie, Frankfurt, 1937, authorized the manufacture of 20,000 tons of bor-superphosphate, allowing only 5 parts of borax by weight to 95 of 18 per cent. superphosphate. The borax admixture was leached out of the soil to an average extent of 78 per cent., so that no damage to succeeding crops from excessive accumulations of boron need be apprehended.

Leach (L. D.). **Effect of downy mildew on Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Technol., 1938*, pp. 64–66, 1938. [Abs. in *Facts ab. Sug.*, xxxiii, 7, pp. 53, 1938.]

Downy mildew [*Peronospora schachtii*] has long been recognized as a serious disease of sugar beets [*R.A.M.*, xv, p. 373; xvii, p. 365] in California, causing a reduction of 30 to 40 per cent. in sucrose production. Observations in 1937 showed that in cases of early infection the beets attain only half their normal size and the sugar yield is substantially diminished. A pronounced degree of resistance has been shown by the Hartmann and Eagle Hill varieties.

Sardiña (J. R.). **La 'grasa' de las Judías (debida a Bacterium medicaginis var. phaseolicola) en España.** [The 'grease spot' disease of French beans (caused by *Bacterium medicaginis* var. *phaseolicola*) in Spain.]—*Bol. Pat. veg. Ent. agric., Madr.*, viii, pp. 231–264, 12 figs., 1938. [German and English summaries.]

The author states that numerous isolations from diseased French bean [*Phaseolus vulgaris*] material sent in since 1933 from the more important bean-producing centres in the provinces of Burgos, Leon, and Huesca in Spain, invariably yielded an organism which inoculation and bacteriological studies proved to be *Bacterium medicaginis* var. *phaseolicola* [see above, p. 716]. Hitherto the disease in Spain is stated to have been ascribed to *Bact. phaseoli* [ibid., xv, p. 765] on the basis of E. F. Smith's determination in 1897 (*Bot. Gaz.*, xxiv, p. 192). The author suggests the retention of the common name 'grasa' [grease] for the disease. A full description is given of the morphological and biological characteristics of *Bact. medicaginis* var. *phaseolicola*, with a few recommendations for its control.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, x, 4, pp. 71–90, 1938.

Estonia. The regulations governing the organization of the plant protection service in Estonia are laid down in an Order of 12th February, 1938, taking effect as from 1st April, 1938, with the exception of the clauses relating to nursery fruit trees, which come into force on 1st April, 1939. The pathogens against which the provisions are directed fall into two categories, one comprising dangerous foreign parasites not yet known to occur in the country and the other consisting of indigenous organisms attacking nursery trees. To the former group belong potato wart (*Synchytrium endobioticum*), Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*), Douglas fir [*Pseudotsuga taxifolia*] needle-fall (*Rhabdocline pseudotsugae*), and the downy and true mildews of the vine (*Plasmopara viticola* and *Uncinula necator*, respectively).

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xii, 5, p. 104, 1938.

Mexico. The Sigatoka disease of bananas (*Cercospora musae*) [*R.A.M.*, xvii, p. 610] is reported to have invaded the principal banana-growing areas of Mexico, viz., Tabasco State and the regions of Soconusco and Mapastepec of Chiapas State. A regulation approved on 11th December, 1937 specifies the control measures to be taken against this disease.

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ZAUMEYER (W. J.). **A streak disease of Peas and its relation to several strains of Alfalfa mosaic virus.**—*J. agric. Res.*, lvi, 10, pp. 747–772, 5 pl., 1938.

An account is given of the author's comparative studies of a new virus disease of peas, of the streak type, attributed to pea streak virus 1 [*R.A.M.*, xvii, p. 220] with three strains of lucerne mosaic virus, designated virus 1, 1A, and 1B [ibid., xv, p. 274]. The origin of the pea streak disease is not definitely known, but it was first observed in the greenhouse at the Arlington Experimental Farm, Virginia, in 1934, and may have originated on mosaic-infected lucerne plants. The results showed that these viruses differed in the symptoms produced on numerous hosts, in their virulence to varieties of peas and beans [*Phaseolus vulgaris*], in their host range, and in their properties *in vitro*. On peas the pea streak virus 1 caused a streaking of the stems, petioles, and main veins of the leaves, but no leaf-mottling, while all the lucerne mosaic viruses produced leaf-mottling and strain 1B also caused a leaf spot and a slight streaking of the stems. The pea streak virus did not infect any host species outside the family Leguminosae; it was not infectious to bean, but all the 17 varieties of peas tested were susceptible to it. The lucerne mosaic viruses, on the other hand, besides being infective to many legumes, also infected tobacco, *Petunia hybrida*, *Datura stramonium*, cucumbers, and *Zinnia elegans*; they produced local necrotic lesions on beans, and of the pea varieties tested Horal alone was immune from all of them.

Special tests showed that the pea streak virus was inactivated between 62° and 65° C., lost its infectivity *in vitro* after two days, and tolerated dilution of about 1 in 5,000. Lucerne mosaic viruses 1 and 1A were inactivated between 65° and 70° in ten minutes, and lucerne mosaic virus 1B between 70° and 75°; all lost their infectivity *in vitro* after four to five days' ageing, and lucerne mosaic virus 1 lost its activity at a dilution of about 1 in 2,000 and the other two strains at about 1 in 3,000. The pea streak virus can be separated from a mixture with the lucerne mosaic viruses by inoculating the Horal pea, which is susceptible to pea streak. The lucerne mosaic viruses can be separated from a mixture with pea streak virus by inoculating beans, soy-bean, cowpea, *Lupinus albus*, and other hosts susceptible to all three of the former but resistant to the latter. Lucerne mosaic viruses 1A and 1B can be separated from a mixture with lucerne mosaic virus 1 by inoculating zinnia or cucumber which are resistant to the last-named, or by

diluting a virus mixture 1 in 3,000, at which dilution lucerne mosaic virus 1 is inactivated but not the other two. Lucerne mosaic virus 1A can be separated by inoculating Pink Cockade sweet pea, which is resistant to the other two strains, and lucerne mosaic virus 1B can be separated by diluting a virus mixture 1 in 1,000 and inoculating the Capucijner pea variety, on which the virus produces a necrotic spotting of the leaves above the point of inoculation; reinoculation of the same variety with the expressed juices of the necrotic tissues and repetition of this process yields lucerne mosaic virus 1B free from the other two strains. So far no method has been found of obtaining the lucerne mosaic virus 1 free from the strains 1A and 1B.

NELSON (R.) & LEWIS (R. W.). **Comparisons of fungicides for control of Celery leaf blights.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xx, 4, pp. 210–221, 1 fig., 1938.

In a further comparative dusting test on two farms in Michigan the best control of early and late blight of celery (*Cercospora apii* and *Septoria apii* and its var. *graveolentis*, respectively) [*R.A.M.*, xvii, p. 498] was given by copper sulphate-lime (standard 20–80), followed by cuprocide (red copper oxide+filler), and then by basicop [ibid., xvii, p. 694], mike sulphur [ibid., xvi, p. 542] giving poor control, but comparatively high yields, presumably because by increasing soil acidity it favoured plant growth. Thirteen applications of the copper dusts were made on one farm, and 16 on the other, each at the rate of 35 to 40 lb. per acre.

In spraying trials on Golden Self Blanching celery an outbreak of bacterial blight (*Bacterium apii*) [ibid., xii, p. 495] occurred, the best control of which was given by Bordeaux mixture (8–12–100), basicop (4–0–100) and cupro-K (copper oxychloride: 8–0–100) giving good commercial control and proving superior to cuprocide-54 (incorporating a sticker). The early and late blights were best controlled by Bordeaux mixture, while basicop and cuprocide-54 gave satisfactory commercial control, and cupro-K was less effective, the yields of the treated plants being increased over those of the unsprayed controls by 25, 22, 23, and 20 per cent., respectively. Twelve applications were made of each spray, at the rate of 100 gals. per acre on each occasion.

In a further test, 11 applications of Bordeaux mixture (8–12–100), basicop, mike sulphur, and copper oxychloride A (4·5–0–100) and B (3·5–0–100) gave, respectively, 23, 32, 115, 70, and 23 infections of leaf blights per leaflet (average), as against 50 in the unsprayed controls. In the authors' experiments the better fungicidal qualities of Bordeaux mixture, as compared with the other materials tested, appeared to be due to its greater adhesiveness during rain. Local growers are advised to depend on Bordeaux mixture (8–12–100) and copper sulphate-lime dust (20–80) for the control of celery leaf blights.

ARK (P. A.) & TOMPKINS (C. M.). **A soft-rot bacteriosis of Pumpkin fruits.**—*Phytopathology*, xxviii, 5, pp. 350–355, 4 figs., 1938.

The bacterium isolated from pumpkin fruits affected by the soft rot already reported from California [*R.A.M.*, xvi, p. 15] has now been

identified as *Erwinia aroideae*. Besides the varieties previously mentioned field observations and greenhouse tests established the susceptibility of 12 varieties of squashes (*Cucurbita maxima*), 7 of cushaws (*C. moschata*), 16 of vegetable marrows (*C. pepo* var. *condensa*), the Lithuanian gourd (*C. pepo ovifera*) vars. *maliformis*, *pyriformis verrucosa*, and *striata elongata*, and the white-flowered gourd (*Lagenaria leucantha*). The only resistant plants were found in an unknown Indian variety of *C. moschata* and in two Lithuanian gourds (vars. *pyriformis striata* and *maliformis lutea*).

The following varieties of celery (a natural host of the pathogen) proved susceptible in inoculation tests: Florida Golden, French Long Top, Golden Phenomenal, Golden Plume and its hybrid, Lagomarsino Special, Long Standing Golden Plume, Tall Paris Golden Yellow, Tethers Special French Tall Strain, and Yellow Hybrid, while Golden Detroit, Utah or Golden Crisp, and Wild Type No. 2 were resistant. The pumpkin strain of *E. aroideae* further disintegrated the fleshy parts of certain *Opuntia* spp., which are ordinarily resistant to the organism.

WIANT (J. S.). **Market-storage studies of Honey Dew Melons and Cantaloups.**—*Tech. Bull. U.S. Dep. Agric.* 613, 19 pp., 5 pl., 1938.

In the course of investigations conducted from 1931 to 1936 Honey Dew melons and cantaloupes were placed in cold storage after their arrival on the New York market from the western States by refrigerator cars and kept at three different ranges of temperature, viz., 32° to 34°, 36° to 38°, and 40° to 42° F., at a relative air humidity varying between 75 and 85 per cent. Careful examination after varying storage periods revealed that Honey Dew melons were subject to a low temperature breakdown after a fortnight's storage at 32° to 34° and to a smaller extent at 36° to 38°, but that the injury did not occur at higher temperatures. Cantaloupes were not affected. The injury is described as a breaking down of the epidermis and rind of the melon, first becoming apparent as a faint water-soaking of the rind accompanied by the oozing-out of juice, but later developing a wide range of symptoms resembling those of spotting, watery breakdown, or scald, with the formation of either small or extensive drab-coloured lesions, which become darker with age. The diseased melons show no internal symptoms, the flesh and the flavour remaining normal except in very severe cases. The most common decay developing on stored melons and cantaloupes at the time of their removal from cold storage or soon after, was caused by *Cladosporium cucumerinum*, which occurred at 40° to 42° after one week of storage and even at 32° to 34° after a fortnight [*R.A.M.*, xvii, p. 155]. The results of the tests suggest that cantaloupes removed from the refrigerator cars can be held in cold storage for one week or slightly longer at 32° to 34° F., while Honey Dew melons can be stored for a fortnight at either 32° to 34° or 36° to 38°, and certain lots for even longer. The riper the melons, the shorter should be the storage period. Frequent inspections of the stored melons are also advised.

Zycha (H.). **Ergebnisse und Probleme der Champignonkultur.** [Results and problems of Mushroom culture.]—*Hedwigia*, lxxvii, 5–6, pp. 294–316, 2 graphs, 1938.

This is a critical discussion of the literature (mostly recent) dealing with various aspects of mushroom [*Psalliota* spp.] culture, including methods of cultivation, the nutritional requirements of the crop (with special reference to the problem of a synthetic fertilizer as a substitute for horse manure [*R.A.M.*, xvii, p. 648]), environmental conditions in relation to growth, average yields, fungal diseases [ibid., xvii, p. 430 *et passim*], and the possibility of introducing or extending the production of other edible fungi [ibid., xvii, p. 649] under German conditions.

Barducci (T. B.). **La selección como medio de lucha contra la marchitez del Ajé.** [Selection as a means of combating Chilli wilt.]—*Inf. Estac. agric., Lima*, 43, 7 pp., 1 fig., 1938.

Full directions are given for the application of the process of selection to the control of wilt (*Fusarium annuum*) in chillies [*R.A.M.*, xvii, p. 371], of which the species most commonly cultivated in Peru (where the disease was first detected in 1935) are stated to be *Capsicum frutescens*, *C. pubescens*, *C. conicum*, and *C. longum*.

Szirmai (J.). **Die 'Dörrfleckenkrankheit' (Hitzeschaden) des Paprikas.** [The 'dry spot disease' (heat injury) of Chilli.]—*Phytopath. Z.*, xi, 1, pp. 1–13, 7 figs., 1938.

The Hungarian chilli crop is stated to be subject to yield reductions of up to 12 per cent. from the 'dry spot disease', characterized by the presence on the apical portion of the fruits of unilateral, oval, yellow lesions, gradually expanding, turning leaden-grey, and rotting in wet weather, while under dry conditions a greyish-blue tinge develops, followed by desiccation. *Alternaria tenuis* occurred in profusion on the necrotic areas, but inoculation experiments with conidial suspensions of the fungus on seeds, seedlings, flowers, and fruits of the Szegedin, Kalinko, and Király varieties gave uniformly negative results. Infection was eventually secured by the introduction of the fungus into the interior of the fruits and leaving the plants without water for a week or placing them in the incubator at a temperature of 25° to 27° C. At the most, therefore, *A. tenuis* is a facultative parasite of chilli plants enfeebled by drought or heat. The symptoms of 'dry spot' were induced in the laboratory on previously moistened areas of the fruits by exposure to hot air at 50° to 52°, but for dry material a minimum of 55° was necessary to secure comparable results. In the greenhouse the dry lesions developed on moistened fruits under exposure to the sun's rays at a minimum temperature of 49°.

Silberschmidt (K.). **O mosaico da Mandioca.** [Cassava mosaic.]—*Biologico*, iv, 6, pp. 177–181, 1 pl., 1 fig., 1938.

The 'Vassourinha' variety of cassava in the State of São Paulo, Brazil, is stated to be relatively frequently affected by a condition, the main symptom of which is the presence on the upper surface of the leaves of yellowish-white spots and streaks, 2 to 3 mm. broad, and on

the under surface of localized, depressed necroses immediately beneath the spots and streaks. These markings stand out particularly clearly on the younger, developing leaves, which are generally deformed, and have irregularly curved veins and crenated margins. As a rule, the spots and streaks are irregularly dispersed over the leaf surface, but not infrequently they occur in the angle between the main and the secondary veins or may develop along the main veins. Similar spots and streaks, but almost exclusively associated with the main veins, were also observed in an undetermined cassava variety in one locality. In the 'Brava preta de Suruhy' variety the condition may appear either as large, coherent yellowish-white spots and streaks enclosing the secondary veins, or as a light green mosaic pattern involving most of the leaf surface, without the development of the yellowish-white markings. The nature of the symptoms, together with the fact that the condition was reported by Alvaro Costa to be transmissible by grafting and by Aleurodid insects, leads the author to believe that one or more viruses may be implicated. So far no harmful effect on the yield of affected cassava plants has been noted in São Paulo, but in view of the economic importance of cassava mosaic [*R.A.M.*, xvii, p. 649] it is recommended that planting material should only be taken from plants free from any suspicious symptom. Preliminary observations indicate that narrow-leaved varieties (e.g., Vassourinha) are less severely attacked than broad-leaved (e.g., Palma).

Bigi (F.) & Ciferri (R.). **Segnalazione della 'Rosetta' dell' Arachide nella Somalia Italiana.** [Groundnut rosette reported from Italian Somaliland.]—*Agricoltura colon.*, xxxii, 3, pp. 105–113, 2 figs., 1938.

Groundnut rosette [*R.A.M.*, xvii, p. 582] has been observed by the two authors independently in the Ginha and Genale areas of Italian Somaliland since 1935. The disease is not at all widespread, but affected plants occur in scattered clumps. Plants that show only rosette symptoms as distinct from leaf mottle appear to be attacked while in an early stage of growth; the leaves are dwarfed, clustered together in rosettes, and, at first, strikingly chlorotic. A description is given of the gradual development of the symptoms of the disease on the Spagnola, Africana, and Khandeish varieties growing under comparable conditions. The symptoms differed very slightly on the three varieties and were also affected by the environmental conditions; on Khandeish (erect habit) chlorosis was more prevalent and more conspicuous than leaf curl, whereas on Africana the reverse obtained. Khandeish was the most susceptible, Spagnola less so, and Africana the most resistant.

The economic importance of the disease is at present almost negligible. Most of the attacks occur as leaf mosaic only, late in the season, *Aphis laburni* is relatively scarce, and the crop is grown close together during two periods separated by a dry season unfavourable to the insect.

In a footnote the authors state that in the south of the country groundnuts are attacked late in the season by leaf spot (*Cercospora personata*) [ibid., xvii, p. 651], while the most prevalent disease in this area is chlorosis due to unfavourable soil and weather conditions.

MARTINOFF (S. I.). Сравнителенъ опитъ съ нѣколко срѣдства за борба съ пепелницата, **Uncinula necator (Schw.) Burr. (Oidium tuckeri Berk.)** по Лозата. [Comparative tests of some preparations for the control of powdery mildew, *Uncinula necator* (Schw.) Burr. (*Oidium tuckeri* Berk.) of the Vine.]—Pamphlet issued by the Plant Protection Institute, Sofia, 19 pp., 1938. [English summary.]

Some details are given of experiments in 1937 at Varna, Bulgaria, the results of which showed that two treatments (on 24th June and 16th July) with a sulphur-containing spray, following three dustings with sulphur, gave better protection to vines against powdery mildew (*Uncinula necator*) [*R.A.M.*, xvii, pp. 194, 652] than six sulphur dustings during the season. Of the sprays tested the best control was obtained with 1 in 80 lime-sulphur, which caused, however, slight scorching, especially when resin soap was added to it. 'Plodorod', a proprietary wettable sulphur, controlled the disease almost as well (especially with the addition of resin soap) as lime-sulphur and did not cause any scorching. Another preparation, 'Baria' (barium polysulphide), also gave satisfactory results without scorching. A mixture of lime-sulphur with 1 per cent. Bordeaux mixture and resin soap, while effective against *U. necator*, produced severe scorching and was not so good as Bordeaux mixture alone against downy mildew (*Plasmopara viticola*).

BOSC (M.). **Résultats d'essais de bouillies cupriques au sulfate d'ammoniaque.** [The results of tests with cupric mixtures containing ammonium sulphate.]—*Progr. agric. vitic.*, cix, 20, pp. 458–461, 1938.

In this paper the author adduces further evidence obtained as a result of inquiries sent out to numerous growers and research workers in France, on the effectiveness of using ammonium sulphate with cupric sprays against vine mildew [*Plasmopara viticola*: *R.A.M.*, xv, p. 628]. The mixture is stated to be more strongly adhesive than Bordeaux mixture. Five years' controlled tests have demonstrated that the new mixture reduces the amount of copper sulphate required, improves the condition of the foliage, and both diminishes the number of lesions that develop and causes them to dry up.

GONÇALVES (R. D.). **Principaes doenças da Videira em São Paulo.** [Chief diseases of the Vine in São Paulo.]—*Biologico*, iv, 1, pp. 8–10; 2, pp. 25–29; 3, pp. 76–82; 4, pp. 115–121; 5, pp. 145–152; 6, pp. 196–200, 10 figs., 1938.

In this series of papers the author gives an account of the major diseases of the vine occurring in the State of São Paulo, Brazil, among which anthracnose (*Sphaceloma ampelinum*) [*Elsinoe ampelina*: *R.A.M.*, xvii, p. 221] is stated to be economically the most important. The other diseases considered include downy mildew (*Plasmopara viticola*); powdery mildew (*Uncinula necator*); leaf blight (*Cercospora viticola*) [*C. vitis*: ibid., xvii, p. 95]; bitter rot (*Melanconium fuligineum*) [ibid., xvi, p. 17]; ripe rot of the grapes (*Glomerella cingulata*) [loc. cit.]; and root rot (*Rosellinia necatrix*) [ibid., xvii, pp. 95, 653]. Control measures are indicated in each case. [This paper, with 12 additional figures, has been issued by the Ministry for Agriculture, Industry, and Commerce of São Paulo, in the form of a pamphlet.]

Demaree (J. B.), Dix (I. W.), & Magoon (C. A.). **Observations on the resistance of Grape varieties to black rot and downy mildew.**—*Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 451–460, 1938.

Observations [which are tabulated] made during 1937 at the Arlington Experiment Farm, Virginia, on the relative resistance of 270 American Euvitis and European Vinifera vines to black rot (*Guignardia bidwellii*) [*R.A.M.*, xvi, p. 17; xvii, p. 95] and downy mildew (*Plasmopara viticola*) [ibid., xvi, p. 627; xvii, p. 652] showed that 27 varieties were conspicuously resistant to both diseases, 17 notably resistant to *P. viticola* but highly susceptible to *G. bidwellii*, 63 highly resistant to *G. bidwellii* but very susceptible to *P. viticola*, 127 moderately to slightly resistant to both, and 36 (of the Vinifera type) highly susceptible to both. Of the varieties very resistant to both diseases, Franklin was unaffected by either, while America, Dakota, Neosho, and Suelter showed only a trace of each. It is concluded that *Vitis riparia*, *V. aestivalis*, *V. lincecomii*, and *V. labrusca* are the most promising sources of desirable material for the development of vines resistant to these diseases.

Petri (L.). **Rassegna dei casi fitopatologici osservati nel 1937.** [Review of phytopathological records noted in 1937.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 1, pp. 1–66, 9 figs., 1938.

This report [cf. *R.A.M.*, xvi, p. 587] contains numerous items of phytopathological interest, of which the following may be mentioned. In January, 1937, vines in the vicinity of Modena were severely affected by 'rogna' (*Bacterium tumefaciens*) [ibid., vi, p. 526; xiv, pp. 676, 740], the white varieties, especially Lugliatica, suffering most; the Lambrusco variety was not attacked.

When vine branches affected with rachitism [ibid., xvii, p. 221] were grafted on to healthy vines and healthy branches on to affected vines the resultant growth was in every case normal. The fruit on the vines affected in 1936 developed and matured in a normal manner, though a few very severely affected vines died. It is concluded that in most cases this form of rachitism is not a progressive, but a curable disease, and is not transmissible by grafting. The cause of the condition is at present unknown.

Vines affected with 'arriciamento' [leaf roll: ibid., xvii, p. 95] showed no improvement following an application of 300 gm. of zinc sulphate, but when an equal quantity of potassium sulphate was added to the application markedly beneficial results were obtained, which persisted into the second year, without any further application, though in the third year the vines relapsed into their original condition.

Peaches in the province of Forli were widely affected by parasitic silver-leaf disease [*Stereum purpureum*: ibid., xiii, p. 385], but the physiological form of the condition [loc. cit.] was uncommon.

Oranges from two localities were attacked by root rot due to *Phytophthora citrophthora*. The Jora Tenga lemon variety, brought from India, was susceptible to mal secco [*Deuterophoma tracheiphila*: ibid., xvii, p. 521], to which the Sinatra and Quattrochi varieties showed marked resistance. The disease was also found in Calabria, where inquiries

indicated that it has been present for about seven years. Mandarin oranges (*Citrus* [*nobilis* var.] *deliciosa*) were attacked by *P. citrophthora* in association with secondary infection by *Botrytis* sp. and *Penicillium* sp.

Siberian elms in the commune of Novellara were attacked by root rot attributed to a species of *Phytophthora*. Canadian poplars (*Populus canadensis*), planted out in 1936, were killed off in May, 1937 to the extent of 90 per cent. as a result of infection by *Dothichiza populea* [ibid., xvii, p. 569]. Canadian poplars and poplars of the Italian variety A.M. bore dry, more or less rounded spots surrounded by a reddish margin in the centre of the leaves due to *Phyllosticta populina* [ibid., xiv, p. 478].

The leaves of *Dianthus caryophyllus* plants from Terracina showed circular, violaceous-red spots with a dry centre revealing the presence of *Phytomonas* [*Bacterium*] *woodsii* [ibid., xiv, p. 365]. *Hydrangea hortensia* leaves showed brown, confluent areas due to *Phyllosticta hydrangeae* [ibid., vi, p. 421].

Lucerne plants from Tripoli showed the presence of *Fusarium oxysporum* var. *medicaginis* [ibid., ix, p. 531], apparently the first record of this fungus from Africa.

EDWARDS (W. H.). **Report on an agricultural survey in the Cayman Islands. With notes on the more important pests and diseases which were found attacking economic plants in that Dependency of Jamaica.**—*Bull. Dep. Sci. Agric. Jamaica*, N.S., 13, 40 pp., 10 figs., 1938.

In the section of this report dealing with plant diseases (pp. 20–27), it is stated that coco-nut bud rot [? *Phytophthora palmivora*: *R.A.M.*, xvii, p. 299] had been primarily responsible for the destruction of groves that once existed in the Cayman Islands. Many cases were noted, but the disease does not at present assume epidemic proportions because the trees are now widely scattered. The disastrous nature of the outbreaks locally has been due to complete neglect of all precautions to prevent spread, though outbreaks can be checked by the immediate destruction of infected palms. The only disease affecting bananas was Panama disease [*Fusarium oxysporum cubense*], which has appeared near George Town in Grand Cayman, and is a very serious menace. Citrus gummosis [? mainly due to *P. parasitica*: ibid., xvi, p. 312] was rampant everywhere.

STELL (F.). **Report of Plant Pathologist, 1937.**—*Rep. Dep. Agric. Trin. Tob. 1937*, pp. 65–70, 1938.

In 1936–7 the average loss of mature cacao pods from witches' broom (*Marasmius perniciosus*) [*R.A.M.*, xvi, p. 728] on 11 plantations in infected areas in Trinidad amounted to 37·5 per cent., though the corresponding loss during the same period at the Government estate at Marper (also situated in a heavily diseased locality, but where all diseased pods and brooms are destroyed four times a year) was only 7·5 per cent. Counts on 100 trees in a heavily infected area in Manzanilla showed that in one complete year 55,471 sporophores were produced, a figure equivalent to 150,000 sporophores per acre of cacao, or 500 sporophores per tree per year.

In 1934 some 150,000 trees were examined to discover resistant types; the work has been continued, and after a process of elimination 12 trees remain which show resistance. A further 60,000 trees were examined in 1936, and all trees with five or more affected tissues were eliminated. As a result, 17 trees out of this lot appear to be highly resistant, but inspection and checking are to be continued before propagation work is undertaken. Seven trees appear to be resistant at Marper.

The Marper estate, comprising 92 acres of cacao, has maintained an average yield of 2½ bags [412 lb.] per acre since its purchase in 1929, as against an estimated yield in the whole district of about 2 bags per acre before 1928, when the disease first appeared. In spite of systematic control, witches' broom is increasing at Marper, pod loss having risen from 2 to 7·5 per cent., with a prospect of a further rise next season. Control costs about $4 per acre per year, and on a commercial plantation this figure would probably be $3 to 3·5. Success, therefore, requires good crops and good prices; the former are largely lacking in many districts, and the latter were unobtainable in January, 1938.

The disease of immortelle trees [*Erythrina velutina* and *E. umbrosa*] previously reported as due to a species of *Sphaerostilbe* [ibid., xv, p. 76] and now stated to be caused by *Calostilbe striispora* (Sacc.) Seaver (syn. *S. musarum* Ashby), has since been found in many different parts of Trinidad, especially where floods are a periodic occurrence.

Since 1936, 248 sour orange trees [*Citrus aurantium*] and 1,740 sour orange seedlings in nurseries have been destroyed, and 150 rough lemon trees [*C. limonia*] and 25 rough lemon seedlings cut out and burnt in an attempt to control scab (*Sphaceloma fawcettii*) [*Elsinoe fawcetti*: ibid., xvii, p. 595] on grapefruit in the Santa Cruz valley in the Northern Range. A survey of the district showed 2,964 grapefruit trees to be mildly affected; the diseased twigs, leaves, and fruits were cut out and burnt. In a small scale experiment, two applications of Burgundy mixture (4–5–50) with milk gave an average of only one scabbed fruit per tree, as compared with an average of 48 scabbed fruits on the unsprayed control trees.

Sporadic cases of mild mottle leaf of citrus occur, and greasy spot [cf. ibid., xv, p. 2] is very common.

Bananas in poor soil and in situations exposed to the wind were particularly susceptible to infection by *Cercospora musae* [ibid., xvii, p. 610]; great care is clearly necessary in the proper selection of sites for banana growing. In Grenada the disease is mild and sporadic, only a very few of the plantings being as yet affected. Almost always, the middle and upper leaves are free from the trouble, which is mostly confined to the lower leaves. Under Grenada conditions, the control measures recommended consist in destroying all the aerial parts of badly affected plants, stripping off and burning or burying infected foliage where infections are mild and scattered, and pruning surplus suckers. Stripping and destroying the affected leaves has given promise of appreciable control.

Report of the Agricultural Department, Dominica, 1937.—Trinidad, Imper. Coll. Trop. Agric., 33 pp., 1938.

The following items of phytopathological interest occur on pp. 14–15

of this report. In 1937 the estimated average monthly incidence of Panama disease (*Fusarium* [*oxysporum*] *cubense*) [*R.A.M.*, xvi, p. 656; xvii, pp. 375, 611] of bananas in the areas inspected amounted to 22 per cent. infected plots and 1·16 per cent. infected stools, as against 29 and 1·58 per cent., respectively, for 1936. These figures do not include abandoned plots or those where the disease is beyond control. Occupiers of plots containing 10 per cent. or more affected stools are forbidden to remove planting material from affected areas. In February, 1938, *Cercospora musae* appeared in one plantation.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 6, pp. 320–324, 4 figs., 7, pp. 386–390, 5 figs., 1938.

By a modification made in March, 1937, in the Plant Diseases Act of New South Wales (1924) every owner and occupier of land on which any tobacco plants have been planted after 30th June in any year must uproot and destroy by burning every such plant by the 30th June of the following year. By this means it is hoped materially to reduce the incidence of blue mould [*Peronospora tabacina*: *R.A.M.*, xvii, p. 565].

The safest method of preventing virus-caused woodiness of passion fruit [*Passiflora edulis*: ibid., xv, p. 593] is for growers to raise their own plants in a locality well removed from older vines, which are always a source of infection. All old and unprofitable vines should be removed and destroyed, and new areas planted as far away as possible from older vines; if healthy seedlings are planted, their remoteness from old vines will largely determine the profitable length of life of the new plantation.

Tomato spotted wilt on Iceland poppies [*Papaver nudicaule*] [ibid., xiv, p. 129; xvii, p. 96] may be controlled by raising seedlings in beds remote from affected plants and promptly removing and destroying the diseased plants; the hands should be washed in soapy water before touching healthy poppies.

In the second of these papers, the importance of winter treatments against vine anthracnose (*Gloeosporium ampelophagum*) [*Elsinoe ampelina*: ibid., xiv, p. 814; xvii, p. 221] is stated to be frequently overlooked in New South Wales. After pruning, all cuttings (as well as the loose, old bark, if circumstances permit) should be removed and burnt. While dormant, the vines should be sprayed or swabbed once or twice with iron sulphate (5 lb.) and sulphuric acid ($\frac{1}{2}$ pint) in water (1 gal.) or with sulphuric acid (1 gal.) in water (10 gals.). The sulphuric acid is recommended where spraying is carried out, but it is also an effective swab. If only one swabbing is given, it should take place as near as possible to the bursting of the buds, but must not be so far delayed as to injure the buds. If two applications are made, the first should be given a month to five weeks before the buds burst, and the second just before they burst. Swabbing reduces the total amount of infective material on the vines and so minimizes the danger of early infection, while by delaying the bursting of the buds for a week or ten days it is advantageous in areas liable to late frosts.

Oats and wheat are frequently attacked by 'purple patch' (*Rhizoctonia* [*Corticium*] *solani*) [ibid., xiii, p. 295]. Field and glasshouse experiments showed that sulphate of ammonia applied before sowing

at the rate of 1 cwt. per acre to areas previously affected or broadcast at the same rate to affected patches appearing in the crop in July and August gave appreciable control, particularly with oats.

Plant pathology.—*Rep. Hawaii agric. Exp. Sta., 1937*, pp. 35–45, 1938.

Further isolation studies have demonstrated that the *Pythium* species previously reported from Hawaii as associated with soft rot of the taro (*Colocasia esculenta*) corm [*R.A.M.*, xvi, p. 301] is the outstanding etiological agent of the disease. The fungus is quite distinct from *P. graminicolum* [see below, p. 735]. Effective control has resulted from drying and ploughing the soil between the crops. In pot tests 5, 21, and 57 per cent. infection occurred in sterilized soil (the inoculum is believed to have been carried on the planting material), unsterilized soil from a diseased area, and sterilized soil later inoculated with the fungus, respectively; the organism was isolated in every case of infection. Laboratory studies showed that the fungus does not grow readily below P_H 5. Plants in infected soils in pots when given water of P_H 4 and P_H 5 grew at least as well as others given water of different P_H values, showed no rot, and gave 30 per cent. more yield than plants given water at other P_H values. Plants grown at P_H 2, 3, 6, and 7·2 showed 40, 40, 20, and 10 per cent. rot, respectively. When plants were grown in pots of fresh soil from a diseased locality (1) thoroughly sun-dried for three weeks, (2) partially sun-dried, and (3) in its natural condition, only the plants in lot (3) became diseased. Significant reductions in infection were given by soil applications, before planting, of a number of chemicals, including copper sulphate (300 and 600 lb. per acre), lime (2 and 4 tons per acre), borax (50 lb. per acre), formalin (8 per cent. solution, 1 pt. per sq. ft.) and mercuric chloride (10 and 20 lb. per acre). Sulphur applications increased the incidence of rot.

Two corms affected by vascular necrosis yielded a Phycomycete from a small percentage of over 200 isolations made. The fungus is characterized by a slow, submerged growth, and inoculations with it gave a reddening and hardening of the vascular tissue somewhat resembling natural infection. In a varietal resistance test in which 32 varieties were planted in soil from an affected area, Weo No. 2202, Haokea No. 2920, Uahiapele No. 2207, Lehuaapei No. 2109, and Makaopio No. 2204 remained unaffected, while Piko Kea No. 2100, Kai Uliuli, and Miyako were slightly attacked.

Of 45 varieties of taro tested none was resistant to *Phytophtnora colocasiae* and only the Manini Uliuli taro variety to *Phyllosticta colocasiophila*. The West Indian eddoe (*Xanthosoma macrophylla*) is resistant to *Phytophthora colocasiae*, but *Phyllosticta colocasiophila* will infect this host if introduced through a broken epidermis. *Phytophthora colocasiae* can be controlled by spraying at intervals of 10 days with Bordeaux mixture (4–4–50), preliminary data indicating that the spraying increases yields by 15 to 20 per cent.

Bliss Triumph potatoes affected with rugose mosaic, and mild mosaic with and without stunting yielded, respectively, 81·6, 170·3, and 344·5 gm. per plant, as against 428·9 gm. in the case of healthy plants (standard error in each case ±43·2 gm.).

A virus disease of the ring spot type caused a mortality of about 25 per cent. in an experimental planting of tomatoes.

Other records include leaf spot (*Coniothyrium zingiberi*) [ibid., xi, p. 74] and a basal rot due to a species of *Fusarium* on ginger, blight (*P. colocasiae*) of periwinkle (*Vinca* sp.), and rhubarb leaf spot (*Phyllosticta straminella*) [ibid., xiv, p. 7].

McNew (G. L.). **Dispersion and growth of bacterial cells suspended in agar.**—*Phytopathology*, xxviii, 6, pp. 387–401, 2 figs., 1 diag., 1938.

Microscopic examination of duplicate broth subcultures of *Phytomonas* [*Aplanobacter*] *stewarti* [*R.A.M.*, xvii, p. 517] dispersed into nutrient agar containing 0·5 or 1·5 per cent. dextrose showed that an average of 99·2 per cent. of the loci occupied by the bacteria had single cells and 80 to 94 per cent. of these cells multiplied. In plates sown with *Erwinia carotovora*, *Phytomonas* [*Pseudomonas*] *campestris*, *Phytomonas* [*Bacterium*] *phaseoli*, *P. angulata* [*Bact. angulatum*], *P.* [*Pseudomonas*] *savastanoi*, *Phytomonas* [*Pseudomonas*] *pisi*, *Phytomonas tabaca* [*Bact. tabacum*], *P.* [*Bact.*] *pruni*, or *P. translucens* var. *undulosa* [*Bact. translucens* var. *undulosum*], over 97 per cent. of the loci had single cells, which grew very readily in all species except *Bact. translucens* var. *undulosum*. The species *P.* [*Bact.*] *tumefaciens*, *P.* [*Bact.*] *juglandis*, *P. insidiosa* [*A. insidiosum*], and *P. michiganensis* [*A. michiganense*] had only 89 to 97 per cent. of the loci occupied by single cells; an examination of their broth suspensions showed that the pairs and clumps of cells existed before the bacteria were placed in the agar. *P. fascians* [ibid., xvi, p. 321] was the only species to produce many clumps of cells in agar. Using the poured-plate technique, therefore, the single cell origin of most cultures may be guaranteed by making several serial dilutions and single colony isolations, the likelihood that a culture of *A. stewarti*, for example, had not been reduced to a single cell in at least one of five successive dilutions being less than 1 in about 3,500,000,000. If a culture does not produce colonies of single-cell origin it is preferable to use other methods.

Sibilia (C.). **Ricerche sulle ruggine dei cereali. VIII. Prime notizie sulla 'Puccinia graminis tritici' in Africa orientale italiana.** [Researches on cereal rusts. VIII. First notes on *Puccinia graminis tritici* in Italian East Africa.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 1, pp. 67–74, 1938.

Continuing his studies on cereal rusts [*R.A.M.*, xvi, pp. 520, 593], the author made seven monospore cultures of *Puccinia graminis* from native wheat grown at Addis Ababa and three monospore cultures of the same species from native wheat grown at Gondar. When grown on twelve differential wheat varieties in Italy all gave substantially the same type of infection on any particular variety, indicating the presence of only one physiologic race, apparently a new one, which the author refers to for the present as A.O. 1. The new race gave no infection on Reliance, Kota, and Vernal, 3 type infections on Khapli, and 4 or 4–3 on the other test varieties. It is not highly virulent, and alone of all the physiologic races of *P. graminis* so far found on the African continent, is unable to infect Kota wheat.

Vohl (G. J.). **Untersuchungen über den Braunrost des Weizens.** [Investigations on the brown rust of Wheat.]—*Z. Zücht.*, A, xxii, 2, pp. 233–270, 3 figs., 1938.

In two years' investigations at the Institute for Plant Culture and Plant Breeding at Halle 336 single spore lines obtained from 101 collections of *Puccinia triticina* on wheat [*R.A.M.*, xvii, pp. 226, 591] from 49 localities of Germany, Finland, France, Holland, Austria, and Sweden were tested on the standard assortment of 8 differential varieties [ibid., xi, p. 288] and showed the presence of the physiological races 11, 13, 14, 15, 16, 19, 20, 21, and 22, of the races 5, 6, 7, 30, 42, and 77, found for the first time in Europe, and of a new race designated 91. The races 11, 13, 14, 15, 20, 21, and 42 were the most prevalent in Germany. The author disagrees with Scheibe, who classified the races into eastern and western groups [ibid., ix, p. 767], since most of the known races have since been found almost everywhere. It would, however, be advantageous to the plant breeder to reduce if possible the number of races he has to consider. Accordingly the author attempts to divide the European races of *P. triticina* into two groups according to their ability to attack the same test plants, one group comprising the races 11, 14, and 15, capable of attacking the test varieties Malakoff and Carina only slightly or not at all, and another group consisting of the races 13, 20, 21, and 42, attacking these varieties strongly.

The results of field experiments, in which 15 varieties of summer wheat were artificially infected with races 11, 13, 14, and 15 at six different stages of growth, showed the varieties Marquis, Marquillo, Thatcher, D.C. 2305, Hope, H 44, 38 M.A., Garnet, and Reward to be resistant in the field to all the races used. These varieties showed the typical rhythm of field resistance, exhibiting susceptibility in the seedling stage, the beginning of resistance in the shooting stage, high resistance at the time of heading and flowering, and a diminution of resistance in the final stages of vegetation. They are recommended for breeding purposes, as are also the varieties Hard Taganrog, Lin Calel, Mindum, Normandie, and Vencedor, which were resistant to some of the races of *P. triticina* in the seedling stage as well as the later stages in the field, though in the case of other races they showed a return to susceptibility in the later stages of growth in the field. The variety Heine's Kolben was highly susceptible at practically all stages.

Greenhouse inoculations of 917 F_2 progenies from 11 crosses, comprising a total of 39,694 plants, showed that the seedling resistance of the parents Ardito and Varonne was governed by a monomeric recessive factor, and that of the parent Normandie by a monomeric dominant factor. The resistance of Ardito and Varonne to the group of races 11, 14, and 15, and of the varieties Normandie and 3972_{30} to races 14 and 15, was found to be transmitted through one factor. Inoculations of 350 F_1 and 8,638 F_2 wheat plants from 5 crosses of summer wheats with winter wheats and 16 crosses of summer wheats showed the field resistance of the resistant summer wheats Marquis and Thatcher to be transmitted as a monomeric recessive factor in crosses with winter wheats. In two crosses with summer wheats, on the other hand, the resistance of Thatcher was found to be transmitted as a dominant factor to the F_1 and F_2 progenies. The baking quality of the crosses

from Marquis and from Thatcher, determined according to Pelshenke's method, was the same in susceptible as in resistant plants, and it is concluded, therefore, that this character is transmitted independently of rust resistance. In crosses between the varieties Lin Calel, 38 M.A., and Hope with H 44 and Hard Taganrog it was found that the field resistance of H 44 and Hard Taganrog was transmitted as a monomeric dominant factor to the F_1 and F_2 generations. In the hybrids Hope$\times 5676_{33}$ and H $44\times 5676_{33}$ resistance was dominant, but the material available was insufficient for a factorial analysis.

Rodenhiser (H. A.) & Quisenberry (K. S.). **Bunt reaction of some varieties of hard red Winter Wheat.**—*J. Amer. Soc. Agron.*, xxx, 6, pp. 484–492, 1938.

Hard red winter wheats were grown for one to six years during the period from 1931 to 1937 in bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] nurseries established at ten experiment stations in the Great Plains States and at Kearneysville, West Virginia, St. Paul, Minnesota, and Logan, Utah. Each nursery contained 50 varieties and strains grown in duplicate rows and inoculated with a mixture of collections of the two bunts [*R.A.M.*, xvii, p. 666] obtained from fields selected at random throughout the State in which the trials were conducted.

No variety or selection of the 162 tested proved to be uniformly bunt-free, but a large number may be classed as resistant, 12 contracting an average of under 1 per cent. infection and 84 less than 10 per cent. Among the resistant varieties may be mentioned some grown commercially, such as Ridit, Minturki, Oro, and Yogo, which, together with the Nebraska Turkey selections C.I. 10016 and 10094, are being used as parents for the development of resistant selections. It is apparent from the experimental data [which are tabulated] that most of the resistance in hybrid lines was contributed by Oro, Martin, and Hussar, with the limited participation of Minturki, though some of the physiologic races of the bunts collected in Montana attacked the four varieties in question. Twelve out of 14 strains of Oro$\times$Tenmarq produced less bunt than the former while all were healthier than the latter parent. The Hope variety proved to be less valuable as a progenitor in winter- than in spring-wheat crosses, having been resistant only to 4 out of 11 races of *T. caries* and to none of the 8 of *T. foetens* used. Only 10 out of 50 wheats showed less than 10 per cent. infection by the dwarfing race of *T. caries* [ibid., xvii, p. 505], which is prevalent in Utah and the Gallatin Valley of Montana and occurs also in Washington and Idaho. Factors for resistance to this race are present in Martin, Hussar, Ioturk, and Relief.

Broadfoot (W. C.) & Tyner (L. E.). **Studies on foot- and root-rot of Wheat. VI. Methods of securing infection of Wheat seedlings for study in nutrient solutions.**—*Canad. J. Res.*, Sect. C, xvi, 6, pp. 253–261, 1938.

In further studies on the foot-rot diseases of wheat caused by *Helminthosporium sativum* and *Fusarium culmorum* [*R.A.M.*, xvii, p. 512], the authors devised a satisfactory method of securing uniform

but not too severe infection of wheat seedlings grown in nutrient culture solutions by germinating the seedlings and immersing their roots before transplanting for about seven to ten days in a culture of the fungus grown in a complete nutrient solution to which a 2 per cent. solution of sugar [volume unspecified] had been added. The severity of the infection was easily controlled by delaying the contact with the inoculum and varying the duration of the contact. The technique also appears to be of value for plants transplanted to soil or sand, but this has not yet been demonstrated experimentally. Of all other methods of infection studied the hypodermic injection of spores of the pathogen into the crown tissue of the seedlings, or adding spore suspensions with or without sugar to the nutrient culture solutions at the time of transplanting the seedlings, produced little or no infection, while adding spore suspensions and sugar to the nutrient culture solutions a few days prior to transplantation gave only fairly satisfactory results, and soaking seeds in spore suspension prior to germination caused rather poor and uneven infection.

VANTERPOOL (T. C.). **Some species of Pythium parasitic on Wheat in Canada and England.**—*Ann. appl. Biol.*, xxv, 3, pp. 529–543, 1 pl., 2 figs., 1938.

The author states that by using the recognized method of isolating Phycomycetous fungi from diseased plant roots he succeeded in obtaining six species of *Pythium* from wheat seedling material collected in Saskatchewan, Canada, and in six wheat-growing counties of England, the pathogenicity of which to cereals was studied by him in small Erlenmeyer flasks, as described in his earlier paper [*R.A.M.*, xi, p. 434]. The ease with which the better-known species of *Pythium* could be obtained from wheat seedlings indicated a wide distribution of these forms in England. Of the six species isolated *P. arrhenomanes* in the wider sense of Rands and Dopp [ibid., xiv, p. 94], *P. volutum* [ibid., xi, p. 434; xiv, p. 240], and *P. tardicrescens* n.sp. were found both in Canada and England; *P. graminicolum* [ibid., xi, p. 435; xvii, p. 384] and a form in general agreement with the description of *P. torulosum* [ibid., xiv, p. 240] were found in England alone; and *P. aristosporum* n.sp. was isolated only in Canada. *P. arrhenomanes* is stated to be very widely distributed and probably to cause more damage to Graminaceous crops than any of the other species under consideration. In England two strains of the fungus were obtained, both of which were larger in average spore size than the Canadian type culture and failed to produce (lobulate) sporangia; both proved to be highly pathogenic to Marquis wheat. *P. graminicolum* was isolated from wheat seedlings grown near Cambridge, and was shown to be more pathogenic to Marquis wheat than a strain from sugar-cane received from Drechsler. The English strains of *P. volutum* agree closely with the Canadian type species in general cultural and morphological characters, and are severely parasitic on wheat seedlings.

P. tardicrescens n.sp. is characterized by irregularly branched hyphae, mostly 2·5 to 5 μ broad, with fine laterals, knob-like appressoria being often present. Toruloid buds or a moderate development of lobulations are infrequently produced in old cultures, and are also observed intra-

cellularly in living tissues; the buds are never complex, and rarely exceed 12 μ in diameter. Zoospore discharge was not seen, but germ-tubes are produced which may terminate in a dark conidium. The oogonia are smooth, terminal on short branches or rarely intercalary, and 17 to 30 (average 24·1) μ in diameter; they form readily in plain agar containing wheat root tips or in water root-tip cultures, but more sparsely on the agar medium alone; the delimiting septum is frequently visible below the edge of the oogonium. The antheridia number up to six, but usually two or three; they are club-shaped or crook-necked, and average 6 to 8·5 μ in width, 10·5 μ from apex to curve, and 5·5 μ from curve to septum, with a fertilization tube of 2 μ diameter; they commonly arise from the oogonial stalk or from a branch, but all may come from neighbouring branches, each of which may supply two or, less often, three. The oospores are smooth, spherical or subspherical, usually free within the oogonium, and 16 to 26 μ in diameter (average 20·3 μ), with a central globule and a wall 1·25 to 2 μ thick.

P. aristosporum n.sp. has hyphae 2·5 to 6·5 μ in diameter and numerous appressoria; conidia up to 40 μ in diameter are sometimes present, germinating by one or more germ-tubes, irregular in course and soon branching. Lobulations develop in due course in old water cultures; at first the individual elements are digitate, but in older complexes they are more often swollen lumps. Germination occurs by numerous tubes; zoospore production was not obtained. The oogonia are smooth, subspherical, terminal or intercalary, most often on short side branches, abundant, 21 to 36 (average 28·8) μ in diameter; the septum is usually some distance from the oogonial wall which persists long after the maturation of the oospore. The antheridia are usually three to six, but sometimes as many as eight or more; they are androgynous and diclinous, club-shaped or crook-necked, moderately narrow, 6·8 μ wide by 10·4 μ from point of contact to curve and 6 to 7 μ from curve to septum, frequently entangling the oogonium; a single branch may supply as many as four antheridia. The oospores are smooth, subspherical, deep brown, usually free within the oogonium, abundant on most substrata, 13 to 30 (average 24·2) μ in diameter, with a central globule, and a wall about 1·5 to 2 μ thick; they germinate by one or more germ-tubes. [Latin diagnoses of both these new species are given.]

The English form of *P. torulosum* is stated to be probably in close agreement with the fungus of the *P. gracile* group described by Petri [ibid., x, p. 592] from Italy, and in spite of certain divergences the author thinks it best for the present to consider the English and the Italian forms as geographic strains of *P. torulosum*, even though it may broaden the concept of this species.

While the damage done in England by species of *Pythium* is not known, the fact that species known to be pathogenic to wheat in other parts of the world have been shown to be present in five counties suggests that they account for a reduction in yields of wheat or other cereals which has hitherto been attributed to other causes. Attention is further drawn to the fact that all the parasitic species isolated belong to the group of the genus with lobulate sporangia; numerous sphaerosporangial forms, however, were also isolated, which, while non-pathogenic or only weakly pathogenic, caused a retardation

of growth in the length of the main seminal roots, with the subsequent development of an excessive number of fine laterals, possibly owing to some toxic product excreted by the fungus; it is suggested that these forms may render the wheat seedlings more liable to attack by the pathogenic forms.

Boewe (G. H.). **Tiny toadstools on crop plants in Illinois.**—*Trans. Ill. Acad. Sci.*, xxx, 2, pp. 103–104, 3 figs., 1937. [Received May, 1938.]

Marasmius tritici, first recorded on wheat in Illinois by P. A. Young in 1925 [*R.A.M.*, iv, p. 474], has also been collected in the State on oats, rye, barley, and *Agropyron repens*. Cereals are also colonized by species of *Naucoria* [ibid., xvii, p. 380]. *M. pyrinus* has been observed on a pear leaf attacked by a leaf-mining insect, and probably the same organism is responsible for a peculiar apple canker produced by the splitting and rolling of the outer bark of the smaller twigs through pressure exerted by the formation in the inner bark of a stromatic cushion giving rise to the sporophore. The stipe of the fungus on living apple twigs is filiform and about 3 mm. long, and the pilei are minute, membranous, and paler-coloured on the under surface.

Nattrass (R. M.). **Diseases of cereals. V.**—*Cyprus agric. J.*, xxxiii, 2, pp. 58–60, 2 figs., 1938.

A brief, popular note is given on barley leaf stripe (*Helminthosporium gramineum*) which, though less widely distributed locally than *H. teres*, is one of the most destructive diseases of barley in Cyprus. Control is recommended by seed disinfection either with formalin solution or with a proprietary organic mercury dust.

Brown (M[abel] R.). **A study of crown rust, Puccinia coronata Corda, in Great Britain. II. The aecidial hosts of P. coronata.**—*Ann. appl. Biol.*, xxv, 3, pp. 506–527, 1 pl., 1 diag., 1938.

Continuing her studies on *Puccinia coronata* [*P. lolii*: *R.A.M.*, xvii, p. 23; cf. also p. 233] the author describes experiments in which she inoculated seedling plants of *Rhamnus frangula* and *R. cathartica*, the two aecidial hosts of the rust in Great Britain, with sporidia from germinating teleutospores collected on a number of grasses, and the grasses with aecidiospores collected in the field on the two species of *Rhamnus*. The results of the first series of tests indicated a considerable degree of specialization of the different varieties of *P. coronata* [loc. cit.], inasmuch as the varieties *alopecuri*, *arrhenatheri*, *avenae*, *festucae*, *holci*, and *lolii* caused infection and produced mature aecidia on *R. cathartica* alone, and the variety *calamagrostidis* only on *R. frangula*; in one experiment, however, the teleutospores of the last-named, collected on *Phalaris arundinacea*, also infected the leaves of *R. cathartica*, but the spermogonia were small and abortive and there were no aecidia. The fact that teleutospores collected in Canada on *Calamagrostis canadensis* when inoculated on to *R. cathartica*, *R. frangula*, and *R. alnifolia* produced aecidia only on the last-named, is held to indicate that the variety of *P. coronata* infecting this grass in Canada differs from that infecting the same genus in Great Britain in its aecidial, as well as in some of its uredinial hosts.

In the grass inoculations series, *Lolium perenne*, *Holcus lanatus*, *Alopecurus pratensis*, *Arrhenatherum avenaceum*, and *Festuca elatior* were infected by aecidiospores from *R. cathartica*, but not from *R. frangula*, and evidence was obtained that the aecidiospores from the former belonged to the varieties *lolii*, *holci*, *arrhenatheri*, and *alopecuri*. *Calamagrostis lanceolata*, *Phalaris arundinacea*, and *Dactylis glomerata* were infected by the aecidiospores from both *Rhamnus* species; on the two first-named grass species the heaviest infection was produced by the inoculum from *R. frangula*, and on the last-named by that from *R. cathartica*; the aecidiospores from the former were shown to belong to var. *calamagrostidis*, but no conclusion could be arrived at in regard to the varieties composing the inoculum from *R. cathartica* which caused slight infection on *C. lanceolata* and *P. arundinacea*. In the case of *D. glomerata* the aecidiospores from *R. cathartica* were found to belong to var. *lolii*, but insufficient material precluded the identification of the variety from *R. frangula* responsible for infection on this grass. *Agropyron repens*, *Bromus sterilis*, and *Agrostis palustris* gave no pustules with aecidiospores from the two species of *Rhamnus*, but the inoculated leaves were usually flecked.

Inoculation tests with aecidiospores from both species on a number of oat varieties in 1933 and 1934 only resulted in a slight infection of the plants, apparently owing to the absence in the aecidial inoculum of the appropriate variety of rust. Spores produced on Fyris oats by aecidiospores from *R. cathartica* were found to belong to the variety *alopecuri*, and those produced on White Cross by aecidiospores from *R. frangula* to var. *calamagrostidis*.

These results are considered to indicate that the difference in aecidial host relationship of the rust varieties is not an adequate criterion for their differentiation as species; it is suggested that the use of the names *P. coronata* Kleb. and *P. coronifera* Kleb. (*P. lolii* Niels.) be discontinued, and the rust be designated by the original name *P. coronata* Corda.

In a final set of experiments it was shown that passage through the alternate host did not appreciably alter the pathogenicity of the rust varieties, and that the latter did not appear to hybridize readily.

Reed (G. M.). **Influence of the growth of the host on smut development.**—*Proc. Amer. phil. Soc.*, lxxix, 2, pp. 303–326, 4 figs., 1938.

This is an expanded account of the writer's studies at the Brooklyn Botanical Garden, New York, on the influence of changes in the growth habit of certain strains of oats, conditioned by nutritional and environmental factors, on the expression of smut (*Ustilago avenae* and *U. levis* [*U. kolleri*]) infection, a preliminary report on which has already appeared [*R.A.M.*, xvi, p. 446].

Itzerott (Dorothea). **Über Keimung und Wachstum von Ustilago zeae (Beckm.) Ung. mit besonderer Berücksichtigung der Infektion.** [On the germination and growth of *Ustilago zeae* (Beckm.) Ung. with special reference to infection.]—*Phytopath. Z.*, xi, 2, pp. 155–180, 1938.

The results of the author's experiments on the germination of spores of *Ustilago zeae* [*R.A.M.*, xvii, p. 387] showed that the spores germi-

nated best at P_H 4·4, but that the germination gradually decreased with an increase of acidity and was finally arrested at $P_H<2·5$, irrespective of the age of the spores. A decrease of acidity beyond P_H 4·4 resulted in the gradual decrease and final inhibition of germination of old spores at $P_H>8·55$, while the germination of young spores was unimpaired. A similar dependence on the P_H values was found to exist in the formation of sporidia and in the growth of the fungus, the inhibition point for the formation of sporidia lying at a slightly lower acidity, namely, $P_H<2·8$. The addition of very small concentrations of arsenic, copper, or mercury to the cultural media completely arrested the germination of spores and the formation of sporidia in the following order of toxicity: As>Cu>Hg. Great fluctuations of temperature were unfavourable to the formation of sporidia only at high hydrogen ion concentrations ($P_H<5·02$) and it is concluded that the slight fluctuations usual for Germany are unlikely to have any effect at all. The isoelectric point of the cell contents of the sporidia is thought to lie between P_H 2·5 and 3·3 and this property may possibly prove to have some importance in connexion with infection. Investigating the modes of infection the author found that infection through the soil was only of small importance, for although the plants often became infected through the soil, they very seldom developed galls. Attempts to produce artificial infection of maize plants by means of injections or by dripping spore suspensions, mixed with different concentrations of fish-oil soap to reduce the surface tension, into the leaf whorls were not very successful, although the second method combined with wounding and applied to very young seedlings promises to give good results eventually. When the plant tissue situated between two galls was examined, no mycelium was detected, suggesting that the infection with *U. zeae* remains local.

Vohl (G. J.). **Mehrjährige Beobachtungen über den Einfluss äusserer Bedingungen auf den Befall des Maises mit Beulenbrand (Ustilago zeae).** [Several years' observations on the influence of external conditions on the infection of Maize by smut (*Ustilago zeae*).]—*Pflanzenbau*, xiv, 12, pp. 465–480, 1938.

A tabulated account is given of the experimental observations made from 1933 to 1937 on the influence of environmental conditions on maize smut (*Ustilago zeae*) in the continental climate of Landsberg a. d. Warthe, Germany [see preceding abstract].

On the basis of varietal reaction tests three groups were distinguished, viz., (1) highly susceptible, represented by the early ripening Chiemgau and Mecklenburg (average infection for the five years 24·2 and 19·1 per cent., respectively); (2) moderately susceptible comprising the early varieties Pfarrkirch, Mahndorf, and Dr. Delille's Early, and the medium-early Giersdorf, Döbeln, Pautzfeld, and Domentzko (12·1, 11·1, 11·5, 16·4, 15·6, 10·8, and 10·2 per cent., respectively); and (3) somewhat resistant, including the medium-early Dr. Delille's Seed Maize, and Pomerania and the 'normal' maturing Janetzki, Yellow Baden, and Caspermeyer's II (7·6, 6·9, 6·4, 7·5, and 9·1 per cent., respectively).

Close planting uniformly reduced the incidence of infection: the

spacing recommended is 60 by 20 cm. for early, 60 by 25 cm. for medium-early, and 60 by 30 cm. for 'normal' maturing varieties. In a test with Pomeranian maize in 1936 the incidence of smut among plants from seed sown on 10th, 20th, and 30th April and 10th May was 13·8, 11, 8, and 6·7 per cent., respectively, the corresponding figures for the same variety and identical sowing dates in 1937 being 10·8, 8·7, 5·7, and 5·1 per cent., respectively. The maximum yield in 1936 (5,276 kg. per hect.) was obtained from the 20th April sowing and in 1937 (5,930 kg. per hect.) from that of 30th April. In a test on the Pomeranian variety in 1935 the incidence of *U. zeae* rose parallel with increasing applications of nitrogen fertilizer to the soil, 50·8, 53·1, and 61·3 smutted plants per sq. m. being counted on the plots receiving the equivalent of 40, 60, and 80 kg. of pure nitrogen per hect., respectively. A similar relationship was observed in 1937 when the smut percentages in plots receiving 0, 40, 60, and 80 kg. nitrogen per hect. were 5·1, 6·2, 6·9, and 8·9, respectively.

ELLIOT (CHARLOTTE). **Bacterial wilt of Sweet Corn in Mexico.**—*Phytopathology*, xxviii, 6, pp. 443–444, 1938.

In December, 1937, the author found lesions similar to those typical for bacterial wilt on the leaves of green maize, growing in the more tropical sections of Orizaba, Oaxaca, and Jalapa, Mexico. Yellow bacterial colonies with growth characters typical of *Aplanobacter stewarti* [see above, p. 732] were obtained from these lesions and inoculations resulted in the production of the typical wilt symptoms on young sweet maize plants in the greenhouse. Some of the diseased green maize plants at Orizaba showed insect feeding injuries similar to those caused by *Chaetocnema pulicaria*, the common vector of the disease in the United States, and a few small flea-beetles collected from these plants were identified as *C. pulicaria*. It is concluded that the disease observed in Mexico is identical with the bacterial wilt in the United States.

SHIH (L.). **Über den Heterothallismus des Staubbrandes, Sphacelotheca cruenta (Kühn) Potter, der Mohrenhirse, Andropogon sorghum Brot.** [On the heterothallism of loose kernel smut, *Sphacelotheca cruenta* (Kühn) Potter, of Sorghum (*Andropogon sorghum* Brot.).] —*Arch. Mikrobiol.*, ix, 2, pp. 167–192, 9 figs., 1 graph, 1938.

Loose kernel smut of sorghum (*Sphacelotheca cruenta*) [*R.A.M.*, xvii, p. 453] was collected in the autumn of 1935 from no fewer than 25 localities in northern China, and the author here fully describes his studies on this material.

The spores of the fungus germinate at a temperature range of 8° to 38° C. with an optimum at 28° to 32°. Generally speaking, the production of hyphae is favoured by relatively high temperatures, while the normal form of germination with promycelium and sporidia occurs at a lower range. Irrespective of temperature, however, spores germinating in malt solution produce exclusively sporidia, while hyphae invariably develop in distilled water. The behaviour of single sporidia of *S. cruenta* corresponded with that of the spores. On an old potato glucose medium the fungus formed a kind of resting spore consisting of several large, thick-walled cells and measuring 40·5 by 5·2 μ compared

with 14 by 3 μ for the ordinary sporidium. The resting spores were still viable to the extent of 5 per cent. after three months in artificial culture, by which time the sporidia have lost all power of germination.

The examination of 119 monosporidial isolations of *S. cruenta* showed the fungus to be sexually bipolar, with sex-determining factors in the ratio of 2 : 2. By means of Dickinson's method [ibid., vi, p. 309] it was possible to separate the four sporidia of a germinated spore. The use of Bauch's medium (20 gm. commercial malt extract, 15 gm. agar, and 1 l. water) revealed the segregation of the bipolar sex factors of the four sporidia (which are entirely independent of those governing cultural characters) in the first reduction division. Hyphal anastomoses, even between lines of the same sex, promote the luxuriant development of the fungus. The hyphae proceeding from single sporidia are simple, straight, and branched at acute angles, whereas those emanating from the union of heterosexual sporidia are undulating, curly, and furnished with small apical disks. A simple method was devised for the observation of the fusion process in heterosexual hyphae on 2 per cent. glucose agar, on the surface of which the sporidia of different sexes in aqueous suspensions were arranged in alternating streaks with a space of 2 to 5 mm. between each. Under these conditions both the chemotropic attraction of the heterosexual hyphae and the spiral branches resulting from their union were clearly apparent.

In seedling inoculation experiments the monosporidial lines caused no infection and the crossed lines very little. Wounded plants were more susceptible to infection than uninjured ones, and though the epicotyl was the most accessible organ, in 47·4 per cent. of cases smut resulted from inoculation of the radicle, ordinarily regarded as immune. Hypodermic injections of germinated spores in the hyphal phase produced more intensive infection than those in the sporidial phase; while similar injections of monosporidial origin in both phases failed.

Reichert (I.). **A decade of research into Citrus diseases in Palestine.**—Reprinted from *Hadar*, xi, 1, 10 pp., 1938.

In this review of work carried out on citrus diseases in Palestine during the last ten years the author deals in turn with conditions affecting seed-beds, nurseries, trees, and fruits, and concludes by referring to local problems on which research is indispensable in the near future.

Hall (E. G.). **Australian Citrus fruits. Handling and storage in relation to wastage.**—*J. Aust. Inst. agric. Sci.*, iv, 2, pp. 85–95, 1 fig., 1938.

Much of the subject matter of this paper is based on the three years' investigations into the problem of wastage of citrus conducted jointly by the Citrus Preservation Committee of the Commonwealth Council for Scientific and Industrial Research and the New South Wales Department of Agriculture [*R.A.M.*, xvii, p. 444]. The wastage of citrus due to fungal activity is attributed mainly to the green and blue moulds (*Penicillium digitatum* and *P. italicum*) and to *Phomopsis* [*Diaporthe*] *citri*, *Diplodia natalensis* [ibid., xvii, p. 310], *Alternaria*, and *Botrytis* spp. all causing stem end rots. *Alternaria* spp. also cause a black centre rot of mandarins and navel end rot of navel oranges.

Button rots, confined superficially to a small area around the buttons, are associated with *Colletotrichum*, *Alternaria*, and *Fusarium* spp. and occur during storage at high temperatures and after cool storage at 45° F. and below. *Phoma citricarpa* [ibid., xvi, p. 601], *Septoria citricola* [ibid., xv, p. 89], and *Colletotrichum* spp. cause rind spots. Of the non-parasitic rind disorders storage spot is most common at temperatures from 37° to 45°, while another type of injury, called cold scald, occurs at temperatures approaching freezing point. The latter consists in the formation of a relatively large superficial or slightly sunken area, lighter in colour than in storage spot, and slightly pitted.

The following methods are recommended to reduce wastage in storage. Pruning out dead wood, spraying, and good orchard cultivation are particularly important for the control of stem end rots; during picking gloves should be worn and every care taken to avoid mechanical injury; a layer of wood wool should be placed at the bottom of the field boxes. Recent experiments have shown that, after picking, sweating for several days at 70° or for a few hours at 100° at a low humidity may be effective in controlling storage spot of Navel oranges. In processing the fruit a 1 per cent. solution of a mixture of sodium metasilicate and soap powder was found to be a good detergent; borax in concentrations of 5 to 8 per cent. at 110° to 120° F. gave consistent control of *Penicillium digitatum*, and reduced the incidence of stem end rots but was relatively ineffective against *P. italicum*. A solution of caustic soda (1 per cent.) or sodium bicarbonate (3 per cent.) gave good control of *P. italicum* but not of *P. digitatum*. Experimental processing of mature fruit at 115° for three minutes was not found to cause injury. Waxing the fruit by the 'hot fog' method proved to be satisfactory on a commercial scale. In local experiments the use of bituminized paper 'Sisalkraft' and of cellophane case liners gave good results in wrapping fruit treated with borax. Although fungal wastage increases with increasing maturity of the fruit at picking time, navels should not be picked before June and Valencias not before September because of the low palatability and susceptibility to storage spot. The best picking time for mandarins from the Hawkesbury River is early June. The best storage temperatures were found to be 50° for grapefruit, 40° for untreated mandarins, 45° for Valencias, and 45° for the early June picked and 40° for the later picked navels.

KURSANOFF (L. I.) & ALEXEYEVA (Mme T. S.). Голубая и зеленая плесень на плодах Цитрусовых. [Blue and green moulds of Citrus fruits.]—*Sovetsk. Subtrop.*, *1938*, 4, pp. 73–77, 1938.

A brief account is given of the authors' studies on *Penicillium digitatum* and *P. italicum* [*R.A.M.*, xvii, p. 311] in pure culture on synthetic media, the results of which showed that for the first-named the minimum P_H for growth was between 2·5 and 3·68, the maximum between 6·8 and 7·42, and the optimum about 5, the corresponding values for the second being between 2 and 2·7, above 6·9, and between 2·95 and 4·64 (the heaviest growth was obtained at 3·3). Of the sugars tested both fungi made best use of fructose and galactose; they were also able to use citric acid as a source of carbon, but not acetic or oxalic acids. Organic nitrogen compounds, and more particularly peptone, proved to

be the best source of nitrogen for both organisms; nitrates were also used to a smaller extent, but ammonium salts were the least available, especially for *P. digitatum*. In experiments in which lemon and tangerine fruits were inoculated through surface wounds with *P. italicum*, the fungus was shown to reduce the saccharose content of tangerines from 21·54 per cent. in the healthy fruit to 10·34 per cent. in the half-invaded, and to 0·4545 per cent. in the fully rotted, and in lemons from 4·546 to 2·35 and 0·895 per cent., respectively. The citric acid content of lemons was also found to be considerably reduced in fully invaded fruits, the value of which for industrial use is therefore greatly lowered. A brief review is appended of control measures recommended in the foreign literature for the control of both blue and green moulds of citrus fruits, which are stated to be very common in the U.S.S.R.

Nunes (D.). **Duas novas espécies para a flora micológica lusitana.** [Two species new to the Portuguese mycological flora.]—*Broteria*, vii, 2, pp. 51–54, 2 figs., 1938.

Oospora citri-aurantii is recorded on lemons and citrons [*R.A.M.*, xvii, p. 310] for the first time in Portugal.

Parker (E. R.). **Progress in mottle leaf control.**—*Calif. Citrogr.*, xxiii, 8, pp. 334, 367, 1 fig.; xxiii, 9, pp. 392–393, 1 fig., 1938.

The results of experiments initiated in 1934 and 1935 at the Citrus Experiment Station, Riverside, indicate that zinc treatment of citrus trees [*R.A.M.*, xvii, p. 596] showing severe symptoms of mottle leaf may result in increased crops of good quality fruit, while mildly affected trees would show no response. Sprays containing zinc compounds in concentrations equivalent to about 1·15 lb. of zinc to 100 gals. of water gave the best control; the effect of spraying lasted for two or three years, and was equally good when the spray was applied at various seasons. For commercial spraying zinc sulphate and zinc oxide are recommended in the following combinations: 5 lb. zinc sulphate (containing 23 to 25 per cent. zinc), 2·5 lb. either hydrated lime or soda ash as precipitants, and 100 gals. water; or $1\frac{1}{3}$ lb. zinc oxide (containing not less than 75 per cent. zinc) and 100 gals. water. Spreaders did not appear to be necessary with these sprays. Zinc oxide incorporated with lime-sulphur is described as a feasible combination spray. In parallel trials zinc dusts proved to be less effective than zinc sprays; none of the dust combinations showed complete control although they may prove quite satisfactory in maintenance treatment of only slightly affected trees. The effect of the dusts was not improved by the addition of 5 per cent. oil or blood albumen as stickers. The zinc dust is most frequently incorporated with sulphur in the usual pest control programme; the cost is therefore slight, and frequent repetition of the treatment is possible. Metallic zinc dust, precipitated zinc sulphide, and zinc oxide derived from high-grade roasted and well-ground ore, were equally good materials for use in dusts. The commercial zinc-sulphur dusts should contain about 5 per cent. zinc oxide and 93 per cent. of sulphur.

[A full account of the work described in this paper appears in *Proc. Amer. Soc. hort. Sci.*, xxxv, pp. 217–226, 1938.]

MORRIS (A. A.). **Some observations on the effects of boron treatment in the control of 'hard fruit' in Citrus.**—*J. Pomol.*, xvi, 2, pp. 167–181, 2 pl., 1938.

Further investigations [which are described, and the results of which are tabulated] carried out in Southern Rhodesia into the serious and widespread physiological disease of citrus known as 'hard' fruit [*R.A.M.*, xvi, p. 528] showed that the boron content of Valencia Late orange fruits was increased by boron applications to the trees (made in the form of top dressings of powdered borax applied at rates ranging from 100 to 1,000 gm. per tree, and aqueous solutions of borax used at 25 to 250 gm. per tree), and that 'hard' fruit symptoms were associated with a low boron content of the fruit. It was also found that the intake by young orange fruits of the common nutrient elements (except, possibly, nitrogen) was not affected by the treatment, though sugars and pectins were lower in fruits deficient in boron than in fruits from trees receiving relatively light boron applications. There was some evidence that high boron treatment retarded the translocation of sugars to the fruit.

Chemical analysis of the ash content of orange leaves from these areas showed that treatment increased the boron content of very young leaves from 5·8, 4·6, and 4·6 parts per million of boron in the dry matter, to 34·2, 76·7, and 28·3 p.p.m., the amount of boron in each sample being roughly proportional to the amount of borax applied; the figures for the mature leaves, untreated, were 11·3, 8·7, and 6·1, as against 95·5, 240, and 41 p.p.m. for the treated. The leaves from severely affected, untreated trees (picked at random in the groves) contained only 4·3 to 11·3 p.p.m. of boron in the dry matter, as against 8·4 to 12·8 p.p.m. of boron in leaves from slightly affected trees, and 14·5 to 18·4 p.p.m. in those from healthy trees.

The total yield obtained from six trees given 50 to 500 gm. of borax was 10,411 fruits, all unaffected, and potentially marketable, as against 4,627 fruits with 3,839 affected from the six untreated controls, i.e., a potential commercial crop of only 788 fruits.

Maturity test data indicated that the boron treatment increased the percentage of juice and soluble solids in mature fruit but delayed the maturing process.

BLISS (D. E.). **Two new species of Omphalia which cause decline disease in Date Palms.**—*Mycologia*, xxx, 3, pp. 313–326, 9 figs., 1 graph, 1938.

Cultures of two species of *Omphalia*, considered to be the cause of decline disease of date palms [*R.A.M.*, xvii, p. 29] were isolated at the Citrus Experiment Station in California from the roots of diseased palms. These fungi do not commonly fruit in the open but a group of 65 toadstools was found at the base of a young Saidy date palm four days after a torrential rainstorm followed by hot and humid weather. Sporulation was induced on inoculated seedlings of *Washingtonia filifera* in the greenhouse, temperatures between 26° and 31° C. and a relative humidity of 92 to 98 per cent. being favourable to its development. The author gives Latin diagnoses and descriptions of the two new

species as follows. *O. pigmentata* n.sp. is typified by abundant, white, silky, rather coarse mycelium resembling glass wool and producing a light orange-yellow to cadmium-orange pigment when grown at 20° to 30° on slants of 2 per cent. potato dextrose agar. The pileus is 5 to 33 mm. broad, pale orange-yellow approaching white with age; the stipe is 5 to 35 mm. long and 0·5 to 2 mm. in diameter; the lamellae are short-decurrent, thin, distant, sometimes branched, very pale orange-yellow to white; the basidia are hyaline and measure 19 to 25 by 5 to 8 μ; and the sporidia are hyaline, oval, papillate, and measure 6 to 9 by 4 to 6·5 μ. *O. tralucida* n. sp. has a white mycelium, finer in texture, and the reverse side of the culture may develop a brown to black discoloration. The pileus is white and then cartridge-buff and 3 to 18 mm. broad; the stipe is 4 to 23 mm. long and 0·3 to 1·7 mm. in diameter; the lamellae are short decurrent, sometimes attached only slightly, thick when young, becoming thinner, distant, branched, intervenous, unequal, white; the basidia are hyaline and measure 32 to 46 by 6 to 12 μ; and the sporidia are hyaline, white in mass, fusiform-ellipsoidal, papillate, and measure 11 to 16 by 3 to 6 μ.

FRANSSEN (C. J. H.) & MULLER (H. R. A.). **Plagen en ziekten van Katoengewas op Java.** [Pests and diseases of the Cotton crop in Java.]—*Landbouw*, xiv, 5–6, pp. 321–362, 3 pl., 1938. [English summary.]

The only serious disease of cotton in Java is stated to be blackarm (*Pseudomonas* [*Bacterium*] *malvacearum*), which generally appears to originate in imported seed and chiefly attacks second-year crops. Control should be based on strictly annual cultivation, the postponement of replanting until the remains of the preceding crop have undergone decomposition, and seed treatment with sulphuric acid and 0·2 per cent. mercuric chloride [full directions for which are given by the Phytopathological Institute on pp. 388–389].

SCHAEFER (E. E.). **Locust fungi.**—*Pamphl. S. Afr. biol. Soc.* 9, p. 21, 1937. [Received August, 1938.]

In a paper read before the South African Biological Society on 16th July, 1936, the author stated that when an aqueous solution of the spores of *Beauveria bassiana* [cf. *R.A.M.*, xv, p. 425; xvi, pp. 68, 531] was sprayed on to locusts in South Africa, nearly all the insects succumbed, if kept in incubators at 78° to 80° F. When kept in cages at the laboratory, only 17 per cent. of the inoculated insects died, while in enclosures in the field only 12 per cent. died as a result of infection. The fungus cultures had no effect on insects in their natural environment, and it is concluded that *B. bassiana* can attack only those locusts whose health has become impaired.

All attempts to cultivate *Empusa grylli* [ibid., xv, p. 216] on artificial media from spores about a fortnight old failed, and it was also found impossible to infect living locusts with the spores. Out of 1,073 hoppers dying of infection in the field, 489, or 47 per cent., contained maggots or nematodes, while of an equal number of apparently healthy locusts only 1·6 per cent. showed similar infestation. It is therefore concluded

that *E. grylli* is able to kill only those locusts whose natural resistance is below normal.

HOPKINS (J. G.). **Ringworm and moniliasis: their differential diagnosis.**—*Penn. med. J.*, xli, 6, pp. 455–472, 24 figs., 1938.

This is a useful survey of the available information on ringworm, moniliasis, and a few pathological conditions of minor importance. Of 6,515 patients examined for skin diseases at the Vanderbilt Clinic, New York, in 1936, at least 5 per cent. were definitely affected with dermatomycoses. The predominating fungi associated with ringworm were *Microsporon audouini* [*R.A.M.*, xvii, p. 680] and *M. felineum* [ibid., xvii, p. 175; xvii, p. 680] (mostly on the scalp) and *Trichophyton mentagrophytes* [ibid., xvii, pp. 599, 680] (largely confined to the feet), while *Monilia* [*Candida*] *albicans* [ibid., xvii, p. 677] was morphologically and serologically established as the agent of paronychia, perlèche [ibid., xvii, p. 528], and other cutaneous disturbances.

JOYEUX (C.) & SAUTET (J.). **Influence de la carence en vitamine A sur l'évolution de la teigne à 'Microsporon felineum'.** [The influence of vitamin A deficiency on the development of ringworm due to *Microsporon felineum*.]—*Bull. Soc. franç. Derm. Syph.*, xlv, 6, pp. 1038–1040, 1938.

The development of ringworm experimentally induced in guinea-pigs by inoculation with a pleomorphic culture of *Microsporon felineum* [see preceding abstract] showed the following tendencies when vitamin A was withheld from the dietary: accelerated extension of the pathogen, exacerbation of the cutaneous reactions, and increased susceptibility to infection as compared with animals supplied with the accessory growth substance.

KAMBAYASHI (T.). **Eine Studie über die systematische Stellung der Trichophyton-Arten. (Soll das Trichophyton lacticolor der Familie 'Gymnoascaceae' eingereiht werden?)** [A study on the systematic position of species of *Trichophyton*. (Should *Trichophyton lacticolor* be included in the family Gymnoascaceae?).]—*Bot. Mag., Tokyo*, lii, 618, pp. 291–297, 6 figs., 1938.

The author was able to observe the formation of asci on a culture of *Trichophyton lacticolor* [*R.A.M.*, xi, p. 784; xvii, p. 176] isolated from an eczema marginatum on a man. The fungus was grown on a drop of agar containing 4 per cent. glucose and 1 per cent. peptone placed on a glass slide and incubated in a moist chamber at 27° C. After 50 hours the ascogonium and the antheridium were found to grow from two neighbouring cells of a hypha. They were very similar in shape, the antheridium being slightly wider and more erect, while the ascogonium wound itself round it in a spiral. A migration of the nuclei could not be observed. The ascogonium divided into many binucleate cells, which eventually developed into ascogenous hyphae and coiled themselves up round the original spiral. In this mass eight-spored asci measuring 11 to 12 by 8·5 to 10 μ in diameter, containing ascospores measuring 3 by 3 to 3 by 6 μ, were found to have developed, and frequently asci with four spores, but the process of formation could

not be followed. Owing to its many points of resemblance to *Gymnoascus reessii* and *Ctenomyces serratus* it is concluded that *T. lacticolor* should be regarded as belonging to the Gymnoascaceae.

Jausion, Hyronimus, & Kouchner. **Eczéma mycosique des ébénistes.** [Mycotic eczema of cabinet-makers.]—*Bull. Soc. méd. Hôp. Paris*, Sér. 3, liv, 19, pp. 953–962, 1938.

Clinical details are given of a case of generalized eczema in a Polish cabinet-maker in Paris due to *Epidermophyton floccosum* [*R.A.M.*, xvii, p. 599], which was isolated in pure culture on Sabouraud's agar and honey water.

Hanan (E. B.) & Zurett (Sophia). **A new species of Madurella: isolation and identification in a case of maduromycosis.**—*Arch. Derm. Syph., Chicago*, xxxvii, 6, pp. 947–966, 9 figs., 1938.

This is a very detailed account of the clinical features of a case of maduromycosis, following the penetration of the left foot by a splinter of wood, in a 36-year-old Indian native resident for 18 years in the United States, and of the cultural and morphological characters of the fungus, *Madurella lackawanna* n.sp. [without a Latin diagnosis], isolated from the diseased tissues.

Growth is successful only on Sabouraud's medium, dextrose agar, and glycerine agar enriched with liver infusion, the last-named apparently containing some factor essential for the development of the organism. The mycelium is white or smoky-grey, with a white peripheral zone in older cultures. The fungus forms coarsely granular hyphae ranging from 1 to 5 μ in diameter, nodular organs, consisting of arthrospores with square-cut ends, and double-walled chlamydospores, 15 to 30 μ in diameter and usually filled with a brown, granular substance. The optimum temperature for its development lies between 20° and 37° C. *M. lackawanna* does not liquefy gelatine, digest milk proteins or fat, or ferment milk lactose. A black pigment was formed in abundance as the chlamydospores reached maturity, but discoloration of the medium took place only in the presence of liver. Negative results were given by animal inoculation experiments.

Carrión (A. L.) & Pimentel-Imbert (M. F.). **Chromoblastomycosis in the Dominican Republic.**—*Puerto Rico J. publ. Hlth*, xiii, 4, pp. 522–530, 5 pl., 1938. [Spanish translation pp. 531–539.]

Full clinical details are given of a case of chromoblastomycosis, believed to be the first in the Dominican Republic, in a 60-year-old coloured man, and of mycological studies on the associated fungus, *Hormodendrum pedrosoi* [*R.A.M.*, xvii, p. 598]. Sporulation was mostly of the *Hormodendrum* type; spore clusters of the *Acrotheca* type were not uncommon, but frequently became catenulate; and there was a sparse formation of *Phialophora*-like conidia. Medlar's 'sclerotic cells' (spherical, thick-walled, deeply pigmented, often septate cells, 8 to 13 μ in diameter) were produced to a slight or moderate extent in older cultures.

SERVAZZI (O.). **Intorno ad un caso di disseccamento osservato su Araucaria.** [On a case of drying-up observed on *Araucaria.*]—*Boll. Lab. sper. R. Oss. Fitopat. Torino*, xv, 1–2, pp. 34–47, 2 pl., 1938. [French, German, and English summaries.]

In the spring of 1938 a number of 4- to 6-year-old potted *Araucaria excelsa* plants rapidly withered and died. The lowest branches were affected first and the disease gradually spread upwards. The extremity of the affected branches bent downwards, and later the whole branch became similarly affected. After the death of the branches the stem dried up from the top downwards. Robust, 5-year-old plants succumbed in less than one month.

Affected material showed the presence of a fungus with subepidermal, globose, blackish perithecia up to 350 μ in diameter, with a beak 200 to 250 by 60 to 80 μ, lined with periphyses up to 60 μ long. The fusiform, slightly curved asci measured 120 to 150 by 15 to 18 μ, were somewhat pointed above and below, and contained eight hyaline, filiform, generally curved ascospores with somewhat pointed ends, measuring 85 to 100 by 3 to 4·5 μ, and arranged in a single fusoid bundle. The young ascospores were unicellular, and the old ones 3- to 12-septate. No paraphyses were present. The young asci were pedicellate, but the pedicel rapidly disappeared, and in mature perithecia the cavity was filled with free asci.

On the thin branches and leaves the perithecia were sparse, whereas on the stem and thick branches they were generally gregarious, and joined at the upper part of the beaks by a disk-shaped pseudoparenchymatous stroma consisting of dark, yellowish-fuliginous parallel hyphae connate with those of the beak. These disks, usually distinctly differentiated from the substratum, developed under the cuticle, which they raised and finally ruptured. They were sometimes over 1 mm. broad, up to 200 μ thick, and united 5 to 8 perithecia. The fungus is named *Cryptospora longispora* n.sp., with a Latin diagnosis.

In culture on malt agar it formed a whitish, flocculent colony which grew rapidly, and gradually turned nearly black, the aerial mycelium becoming fuliginous. After 20 days numerous rudimentary perithecia were present but these failed to mature, and similar colonies, with pseudosclerotia, formed on potato agar. Mature perithecia developed on peptone-pepsin-soy agar, rice agar, and apple stems; they were papillate, instead of beaked, except on the last-named. Inoculation experiments on young, healthy, wounded *A. excelsa* plants gave positive results, demonstrating that the fungus is a virulent wound parasite.

DOWSON (W. J.), MOORE (W. C.), & OGILVIE (L.). **A bacterial disease of Begonia.**—*J. R. hort. Soc.*, lxiii, 6, pp. 286–290, 3 pl. (facing pp. 269, 284, 285), 1938.

Winter-flowering begonias in various parts of England have been suffering during the last few years from a bacterial disease characterized by symptoms closely similar to those reported on the same host from the Continent [*R.A.M.*, xvii, p. 602]. Numerous popular varieties are affected, among the most susceptible being Clibran's Pink, Altrincham Pink, and Optima, while considerable resistance is shown by Ege's

Favourite, Exquisite, Pink Perfection, Fascination, Star, and Flambeau; Gloire de Lorraine and summer-bedding varieties of the *Begonia semperflorens* type do not appear to contract infection.

The bacterium isolated from the diseased tissues was inoculated into healthy plants by spraying, with positive results, and reisolated. It is an actively motile rod, staining with carbol thionin blue and Congo red relief, rod-shaped or oval, the former measuring 0·9 to 1·7 by 0·5 μ and the latter 0·9 by 0·5 μ. In pure culture on nutrient agar or steamed potato the dimensions of the individual cells may be increased to 1·7 to 2 by 0·6 μ, and those of the double structures formed by the adhesion of two daughter cells to 2·6 to 3·5 by 0·6 μ. On nutrient agar at 27° C. the mustard-yellow, flat, shining, imperfectly circular colonies attain a diameter of 5 mm. in a week. The organism possesses one long polar flagellum (Morton's light blue staining method), is Gram-negative, non-acid-fast, liquefies gelatine slowly, forms a little acid after three weeks in dextrose, sucrose, lactose, and maltose, rapidly digests starch, forms hydrogen sulphide and ammonia from peptone, but not indol, and reduces nitrates to nitrites. These characters approximate most nearly to those of the bacterial pathogen of begonias in Denmark incompletely described by Buchwald as *Bacterium begoniae* and it is therefore proposed to refer the English organism to this species for which the name *Pseudomonas begoniae* (Buchw.) Pape emend. Dows. is provisionally adopted; it appears to be distinct from *Bact. flavozonatum* and from *Phytomonas flava begoniae* [loc. cit.]. A bacterial culture isolated from leaf spots on *Begonia tuberosa* in Portugal and sent to the first-named author by Mme M. D'Oliveira was also found to correspond in all particulars with the English pathogen.

Appropriate control measures are recommended, based on scrupulous attention to hygiene and the sterilization of workers' hands, implements, and the soil for raising cuttings, which should be taken from plants isolated in a disinfected greenhouse. There is some evidence that infection may be water-borne, and the plants should therefore be watered from a mains supply rather than from tanks, which may easily be contaminated by refuse. Humidity should be strictly regulated, ample ventilation provided, and wounds (through which the bacteria are most likely to enter the plants) carefully avoided.

CHESTER (F. D.). **A bacteriosis of Dahlia, Erwinia cytolytica.**—*Phytopathology*, xxviii, 6, pp. 427–432, 1938.

A stem rot of dahlia, characterized by a blackening and softening of the stem, was observed in 1936 in the New York Botanical Garden and from the bacteria present in the decayed tissues the causal organism was isolated and successfully reproduced the disease on inoculation into healthy plants. It is considered to be new and is named *Erwinia cytolytica*. It is a short rod averaging 1·5 to 4 by 0·7 μ, actively motile by peritrichous flagella, forming circular, convex, watery, glistening, pale greyish, and translucent colonies, which average 2 mm. in diameter after two days at 25 to 30° C. It is aerobic and facultatively anaerobic, reduces nitrates to nitrites, does not form indol or hydrogen sulphide, hydrolyses starch, grows well in Fermi's solution but not at all in Cohn's, produces (in synthetic media containing mineral salts and

ammonium phosphate) acid without gas from dextrose, lactose, sucrose, raffinose, mannite, salicin, and isodulcite, but no acid from levulose, arabinose, xylose, glycerose, or inulin, slowly liquefies gelatine, grows at 37° C. but not at 8° to 10°, with an optimum at 28° to 30°, and at P_H 6·8 to 7·3, feebly at P_H 5·0, and not at all at P_H 4·4.

HOPKINS (J. C. F.). **A note on a stem rot of Sweet Peas.**—*Rhod. agric. J.*, xxxv, 6, pp. 417–418, 1938.

Wilting and death of sweet peas [*Lathyrus odoratus*] after emergence from the soil commonly occur every year in Rhodesia. From such material *Fusarium solani* var. *martii* was isolated in 1938. Affected seedlings showed pale brown or cream coloured lesions on the stem at soil level; in severe cases the stems exhibited marked constrictions, whereas in milder cases the plants showed only a small depression on one side, and sometimes the cotyledons showed small pale spots or else shrivelling of the margin. The severe attack of the disease occurred following a sudden hot, dry spell, and was controlled by watering with Cheshunt compound, consisting of 2 oz. copper sulphate and 11 oz. of ammonium carbonate.

MUNDKUR (B. B.). **Urocystis sorosporioides, a new record for India.**—*Trans. Brit. mycol. Soc.*, xxi, 3–4, pp. 240–242, 1 pl., 1938.

The leaves and petioles of a species of *Delphinium* (either *D. denudatum* or *D. vestitum*) growing at Simla in July, 1935, showed swellings caused by the smut *Urocystis sorosporioides*. This is stated to be the first record of this fungus in India [cf. *R.A.M.*, xvi, p. 515]. Leaves of a species of *Delphinium* collected at Chakratha were also attacked by the same smut.

SIMON (E.). **Die Orchideenwelke, ein gefährlicher Parasit der Warmhauspflanzen.** [Orchid wilt, a dangerous parasitic disease of hothouse plants.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 22, pp. 254–256, 1 fig., 1938.

After a number of preliminary tests [details of which are given] the writer found that *Sclerotium rolfsii*, the agent of a virulent wilt of Orchidaceae [*R.A.M.*, xv, p. 99], e.g. *Pyrrheima loddigesii* and other hothouse plants in Germany, may be effectively combated by 15 minutes' immersion of the root clumps in 0·1 per cent. ceresan. The concentration of 0·25 per cent. recommended by K. Flachs destroyed the sclerotia of the fungus on various plants but at the same time caused extremely severe injury. The fungicide is powerless to reach the sclerotia in the interior of rhizomes, e.g. of *Polypodium*, so that careful selection of planting material is indicated. *S. rolfsii* thrives on fresh beech leaf mould. Scrupulous care in the sanitation of the orchid house must be exercised and a 10 per cent. copper sulphate solution should be applied to the walls and flooring, and also used for the immersion of pots and planting-baskets.

MAXWELL (K. E.). **Report on experiments to control leaf spot on Irises.** Reprinted from *Flor. Rev.*, lxxx, 2072, pp. 24–25, 1 fig., 1937. [Received September, 1938.]

Substantial reductions of iris leaf spot (*Didymellina macrospora*)

[*R.A.M.*, xvii, p. 507] were obtained in Long Island, New York, in 1935 and 1936, by two to three applications of Bordeaux mixture (4–4–50) or flotation sulphur (4–50), with the addition of a wetter and spreader of potassium resin soap (2 parts of resin, 1 part potassium hydroxide, 3 parts water used at the rate of 3 teaspoonsful per gal.). Green kolodust (sulphur) was also moderately effective, but less so than an equivalent number of spray treatments. The Black Midget, Dejah, Duke of York, Germaine Perthius, Glee, and Her Majesty varieties and 15 others proved to be highly resistant to leaf spot, but a large number of varieties [which are listed] were all more or less susceptible.

MILBRATH (J. A.). **Diseases of ornamental shrubs in Oregon.**—*Plant Dis. Reptr*, xxii, 11, pp. 210–211, 1938.

A severe outbreak of powdery mildew (*Sphaerotheca pannosa*) was recently observed in western Oregon on *Photinia serrulata* [*R.A.M.*, xvi, p. 538]. Abundant spores of the *Oidium* stage (*O. leucoconium*) were noted, but no perithecia. This appears to be the first record of the species on *Photinia* in the United States, though in a footnote it is pointed out that Yarwood [ibid., xvi, p. 839] reported a powdery mildew with conidiophores of the *Podosphaera leucotricha* type on *Photinia glabra* and *P. serrulata* from California in 1937.

DICKEY (R. D.) & REUTHER (W.). **Manganese sulfate as a corrective for a chlorosis of certain ornamental plants.**—*Bull. Fla agric. Exp. Sta.* 319, 18 pp., 9 figs., 1938.

A chlorosis of crape myrtle (*Lagerstroemia indica*), *Bougainvillea, Allamanda cathartica*, cattley guava (*Psidium cattleianum*), *Thunbergia grandiflora*, flame vine (*Bignonia venusta*), and *Agyneja impubes* is widespread on overlimed as well as acid sandy and calcareous soils in Florida. Chlorotic leaves of crape myrtle show yellowish green to pale yellow areas between the midrib and primary veins extending until most of the lamina is occupied, when deep reddish blotches [not reported on other plants], indefinite in outline and extent, appear in the chlorotic areas. Finally the leaves become light yellow, on which are suffused red to purple anthocyanin pigments. Diseased leaves recovered and completely greened up three weeks after the affected shoots were dipped in a 0·5 per cent. solution of a CP grade of manganese sulphate mixed with an equal amount of calcium caseinate spreader, and similarly good control varying only in time was obtained with all other above-named ornamentals. Spray treatment is therefore recommended, preferably in spring preceding a period of rapid growth, with a spray mixture containing 2 oz. 80 per cent. manganese sulphate, 2½ gals. water, 1 oz. hydrated lime, and possibly a spreader. Limited trials with soil treatment, made on crape myrtle only, indicated that applications of manganese sulphate (1 lb. or more per tree) effectively controlled the disorder, recovery being attained in 30 days in some instances. It is believed that soil treatment will eventually prove to be the most permanent and practical measure; it cannot yet, however, be recommended for general use pending more adequate field trials.

NAGATOMO (I.). **Notes on two diseases of ornamental plants caused by Cercospora.**—*Forsch. PflKr., Kyoto*, iii, pp. 109–114, 4 figs., 1937. [Received August, 1938.]

English and Latin diagnoses are given of *Cercospora nandinae* n.sp. (originally described by the writer in Japanese in 'Studies in middle-school education: materials for education', III, p. 79, 1932), the agent of a smoky-grey, later reddish-brown or reddish-purple, confluent spotting of the leaves and petioles of *Nandina domestica*, prevalent in the south of Japan. *C. althaeina* was observed forming dark brown, later greyish-white spots on the leaf blades, petioles, and stems of *Althaea rosea* [*R.A.M.*, xvi, p. 492] near Maizuru, Kyoto Prefecture.

PAPE (H.). **Der Filzrost der Päonie.** [Felt rust of the Peony.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 23, pp. 269–270, 2 figs., 1938.

A semi-popular account is given of the so-called 'felt' rust of peonies (*Cronartium asclepiadeum*), emphasizing its genetic connexion with the aecidial stage (*Peridermium cornui*) on pines (*Pinus sylvestris*) [*R.A.M.*, iv, p. 376; xvii, p. 281]. The common name of the rust is explained by the dense, dark brown coating of teleutospores formed on the lower leaf surfaces. In order to prevent the transmission of the 'felt' rust from pines to peonies, the former should be thoroughly inspected in the spring and all diseased material excised and burnt, while the latter should be repeatedly sprayed throughout the growing season with a copper-containing preparation.

INGELSTRÖM (E.). **Några aktuella sjukdomar på prydnadsväxter.** [Some diseases at present affecting ornamental plants.]—*Växtskyddsnotiser Växtskyddsinst., Stockh., 1938*, 2, pp. 22–24, 1938.

Popular notes are given on the incidence and control of the following diseases of ornamentals investigated at the Swedish Plant Protection Institute during the winter of 1937–8: *Botrytis galanthina* on snowdrops (*Galanthus nivalis*) [*R.A.M.*, xv, p. 442], *Entyloma dahliae* on *Dahlia variabilis* [ibid., xvii, p. 655], a virus disease of *Iris filifolia imperator*, agreeing in all particulars with that reported from the United States and elsewhere under the name of 'yellow stripe' [cf. ibid., xvi, pp. 254, 728] and causing a reduction of 60 per cent. in the number of saleable plants; and *Armillaria mellea* on *Thuja occidentalis*.

For the control of *B. galanthina* the writer recommends soil disinfection with 1 in 20 formalin and 30 minutes' immersion of the bulbs in mercuric chloride 1 in 750 or formalin 1 in 120, preceded by one hour's soaking in water. Repeated applications of 1 per cent. Bordeaux mixture are stated to be effective against *E. dahliae*, while liming of the soil is also advisable. The following varieties are resistant: Fürstin Henkel von Donnersmark, Wolfgang von Goethe, Heideprinzess (cactus types), Herbstkönig, Kupfergold, Pinoe, Maria Stuart (hybrids), Fanal, F. C. Heineman, Lucifer, Owen Thomas (single), Dr. Hirschbrunn, Fashion, Goldhähnchen, and Ladybird (pompoms).

JONES (W.). **Downy mildew of the Rose in British Columbia.**—*Sci. Agric.*, xviii, 10, pp. 627–628, 1 pl., 1938.

In July, 1937, rose downy mildew (*Peronospora sparsa*) [*R.A.M.*,

xvii, p. 682] caused considerable damage to Portadown and Lord Lonsdale roses in a low-lying garden in West Vancouver, British Columbia, slight infection also occurring on the varieties Mrs. Gladys Peach, Mrs. H. Morse, Mrs. Laxton, Lal, Crimson Glory, Trigo, and Mrs. C. Lamplough. The disease was also observed slightly attacking roses growing outdoors in two other localities. The affected leaves showed pale- to purplish-red, irregular spots and areas on the lamina and frequently along the veins; reddish to purplish areas were present on the stems, and brown spots or areas on the petals. Most of the affected flowers were spoiled.

DAVIS (B. H.). **The Cercospora leaf spot of Rose caused by Mycosphaerella rosicola.**—*Mycologia*, xxx, 3, pp. 282–298, 7 figs., 1938.

This is a full description of the author's studies on the leaf spot of roses caused by *Cercospora rosicola*, the imperfect stage of *Mycosphaerella rosicola*, a preliminary account of which has already been noticed [*R.A.M.*, xvi, p. 462]. The disease only affects the leaves, on which circular, well-defined spots appear, up to 10 mm. in diameter. The centre is necrotic and surrounded by a narrow brown or raisin black border, with sometimes an outer purplish zone. No data are available on the losses caused by the disease, but attacked plants may be practically defoliated by the middle of August. The perfect stage of the fungus is named *M. rosicola* (Pass.) n. comb. [n.sp.] with the following diagnosis in English: perithecia amphigenous but usually hypophyllous, erumpent, black, borne singly but rather thickly, 65 to 105 μ in diameter; asci astipitate, clavate, with walls thickened towards the tips, 36 to 57 by 9 to 11 μ, usually 45 by 9 μ; aparaphysate; ascospores olivaceous, biseriate or sub-biseriate, unequally 2-celled with the smaller cell towards the apex of the ascus, slightly curved on one side and flattened on the other, rounded at the ends, 13 to 17 by 4 to 5·3 μ. From a comparative study of herbarium material the author concludes that only three species of *Cercospora* out of the ten described on roses are valid, viz. *C. rosae* (Fuck.) von Höhn. (syn. *Exosporium rosae*, *C. hypophylla*, *C. rosae-alpinae*); *C. rosicola* (syn. *C. rosigena*, *C. rosicola* var. *undosa*, *C. rosae* van Hook, *C. rosae-indianensis*); and *C. hyalina* [ibid., xv, p. 59]. Revised descriptions of the first two species are given, together with a diagnosis in English of *C. puderii* n.sp. [ibid., xvi, p. 463] found on rose leaves in Florida. This new species produces spots with minute white centres and reddish-brown margins, forms prominent brown stromata, 18 to 36 μ in diameter, bearing dense fascicles of olivaceous conidiophores, brownish at the base, not geniculate or slightly so, 13 to 24 by 2·6 to 4 μ, with obclavate conidia with a heeled base, pale olivaceous, 1- to 7-septate, straight or curved, 30 to 75 by 2·0 to 3·5 μ.

VOORHEES (R. K.). **Eye-spot disease of Napier Grass.**—*Phytopathology*, xxviii, 6, pp. 438–443, 3 figs., 1938.

The author describes the symptoms of an eye-spot disease of Napier grass (*Pennisetum purpureum*), first observed at Gainesville, Florida, in 1935, due to a fungus with morphological characters closely agreeing

with those of *Helminthosporium ocellum* [*R.A.M.*, xvii, p. 487], to which it is referred. The spots on the leaves are at first small, roughly oval, and reddish-brown; later on the centre becomes a lighter brown and finally the colour of dirty straw, while the margins become a deep red. The older spots vary in size from 1·5 to 3 mm. wide by 2 to 5 mm. long and usually remain oval or develop into elongated streaks. Heavily affected leaves wither and drop prematurely. On very susceptible strains of the grass, spots similar to those on the leaves, but brown rather than red, develop also on the leaf sheaths and stems. In inoculation experiments none of the plants immune from the disease in the field became infected in the greenhouse, but on field-selected susceptible plants small, water-soaked flecks were formed, sometimes 12 but mostly 24 hours after inoculation, and developed into spots closely resembling those observed in the field.

PETERSEN (GRACE A.). **Perithecial material of Erysiphe and Microsphaera on Trifolium pratense.**—*Mycologia*, xxx, 3, pp. 299–301, 1 fig., 1938.

Apart from a collection by J. L. Sheldon of perithecial material of *Erysiphe polygoni* [*R.A.M.*, xvi, p. 104] on *Trifolium pratense* in 1908, in West Virginia, the perfect stage of this fungus is not known to have been found on red clover in the eastern United States though perithecia have been recorded from several of the western States. In the summer of 1937 the author collected at Ithaca, New York, the perfect stage of *E. polygoni* on *T. pratense* from two stations and perithecia of *Microsphaera alni* (Wallr.) Salmon from four other stations, though none of the leaves bore more than a few perithecia. *M. alni* has, to the author's knowledge, never before been reported on *Trifolium* either in America or elsewhere.

HEY (A.). **Versuche zur Sicherung des Serradellaanbaues und zur Abwehr der Stengelbrennerkrankheit (Anthraknose).** [Experiments to safeguard the Serradella crop and prevent the stem-burner disease (anthracnose).]—*Landw. Jb.*, lxxxvi, 1, pp. 1–21, 6 figs., 5 graphs, 1938.

This is an expanded account of the writer's studies (with M. Klinkowski and H. Richter) on anthracnose (*Colletotrichum trifolii*) of serradella (*Ornithopus sativus*) in Germany [*R.A.M.*, xvi, p. 540] and its control by appropriate cultural measures, notably late (June) sowing and crop rotation, supplemented in certain circumstances by seed disinfection with 0·125 per cent. germisan.

RICHTER (H.) & KLINKOWSKI (M.). **Wirtelpilz-Welkekrankheit an Luzerne und Esparsette (Erreger: Verticillium albo-atrum Rke et Berth.).** [The whorl fungus wilt disease of Lucerne and Sainfoin (causal organism: *Verticillium albo-atrum* Rke & Berth.).]—*NachrBl. dtsch. PflSchDienst*, xviii, 7, pp. 57–58, 2 figs., 1938.

Two new hosts of *Verticillium albo-atrum* have been detected of recent years in Germany, namely, lucerne near Bonn and sainfoin (*Onobrychis sativa*) at Berlin-Dahlem. Transverse sections through

diseased lucerne roots revealed the typical circular, brown discolorations of the vessels, frequently extending to the adjacent sclerenchyma cell groups. Positive results were obtained in inoculation tests in which six-months-old lucerne plants were dipped in a loam emulsion permeated by the fungus and grown in pots in the greenhouse, the characteristic wilt symptoms beginning to develop after eight weeks and *V. albo-atrum* being reisolated from the discoloured vascular tissues.

In the case of *O. sativa* the fungus rapidly killed the plants, ruptured the dry, dead stems, and produced its well-known verticillate conidiophores on the surface.

Barbacka (Mme K.). **Obecny stan badań nad guzowatością korzeni (Bacterium tumefaciens Sm. et Town.) u drzew owocowych, jej szkodliwością i zwalczaniem.** [The present status of studies on the harmful effects of crown gall (*Bacterium tumefaciens* Sm. & Town.) on fruit trees, and its control.]—Reprinted from *Prace Wydz. Chor. Szkodn. Rosl. państw. Inst. Nauk. Gosp. wiejsk. Bydgoszczy*, 17, pp. 5–17, 1938. [English summary.]

The author reviews the present status of knowledge of the crown gall organism *Bacterium tumefaciens* [*R.A.M.*, xvii, p. 448, and above, p. 732] and states that her own researches have shown that the disease exerts a distinctly harmful effect on the growth of seedlings. No really satisfactory method of control has as yet been found, but in experiments carried out by her on young fruit trees [unspecified] planted in heavily infected land, a reduction of infection from 39·5 per cent. in the control to 33·9 per cent. was obtained by disinfecting the soil with calcium chloride (at a rate of 30 gm. per sq. m.) and a reduction from 49·3 per cent. infection in the control to 27·8 per cent. by steeping the roots before planting in a mixture of water, clay, and uspulun (0·5 per cent.). In Poland pears were found to be the most severely attacked of all fruit trees in the nurseries, and apples came second.

Hopkins (J. C. F.) & Bacon (Aline L.). **Common diseases of Apples and their control in Southern Rhodesia.**—*Rhod. agric. J.*, xxxv, 6, pp. 452–466, 2 pl., 1938.

A popular account is given of the diseases of apples occurring in Southern Rhodesia and their control by orchard sanitation and spraying. The diseases dealt with include, besides those mentioned in an earlier publication [*R.A.M.*, xvii, p. 45], die-back and canker (*Botryosphaeria ribis chromogena*) [ibid., xv, p, 238], sooty blotch (*Gloeodes pomigena*), die-back (*Phomopsis mali*) [ibid., xv, p. 33; xvii, p. 466], soft brown rot (*Alternaria* spp.), water-core [ibid., xv, p. 302], and measles [ibid., xvii, p. 608].

Bongini (V[irginia]). **Nebbia del Ciliegio.** [Cherry leaf scorch.]—*Boll. Lab. sper. R. Oss. Fitopat. Torino*, xv, 1–2, pp. 20–29, 2 pl., 1938.

After stating that cherry leaf scorch (*Gnomonia erythrostoma*) [*R.A.M.*, x, p. 802], formerly seldom found in Italy, occurred in epidemic form in 1937 in Piedmont, following a rather limited outbreak in 1936, the author gives a full account of the disease in semi-popular terms, based largely on the literature of the subject.

Willbirger (H.). **Erfahrungen in der Schorfbekämpfung beim Kernobst mit der 'Blauspritzung' und der Spritzmischung Kupfer+Schwefel am Bodensee.** [Experimental observations on scab control in pome fruits with 'blue spray' and the spray mixture copper+sulphur on the Lake of Constance.]—*Obst- u. Gemüseb.*, lxxxiv, 4, pp. 54–56, 3 figs., 1938.

In experiments against apple scab (*Fusicladium*) [*Venturia inaequalis*] in 1936 and 1937 in a district of Württemberg (Germany) bordering on the Lake of Constance, the application of a 'blue' spray (3 per cent. Bordeaux mixture) [*R.A.M.*, xvii, p. 375] just as the buds were beginning to open gave very satisfactory results and obviated the necessity of a further pre-blossom treatment. Great care should be exercised in the use of combined lime-sulphur and copper sprays, the maximum concentration permissible for the former being 2 per cent. (1 per cent. in dry weather) and for the latter (cupromaag) 0·05 per cent. Even with these precautions injuries of various kinds are apt to result in the case of sensitive varieties, such as Boskoop, Ontario, and Teuringer Rambour.

Dunegan (J. C.). **The rust of stone fruits.**—*Phytopathology*, xxviii, 6, pp. 411–427, 2 figs., 1938.

An investigation into the marked variations noted in the prevalence and importance of the rust disease attacking primarily the leaves but sometimes also the fruit of *Prunus* spp., caused by the fungus *Tranzschelia* [*Puccinia*] *pruni-spinosae* [*R.A.M.*, xvi, p. 776] revealed that uredospores from cultivated hosts from various parts of the United States would infect peach leaves but not those of wild species of *Prunus*. Conversely, uredospores from various wild hosts would not infect the peach. Aecidiospores from species of *Anemone* would not infect the peach but would infect wild species of *Prunus*, whereas aecidiospores from a cultivated species of *Anemone* would infect peach leaves but not those of wild species. In an examination of 389 herbarium specimens the teleutospores produced on the leaves of cultivated species of *Prunus* were found to be of the same type practically throughout the world and to be morphologically different from those on the leaves of wild species. It is concluded that there exist two distinct forms of the rust fungus, and the name *T. pruni-spinosae typica* (*T. pruni-spinosae* forma *typica* Fischer) is proposed for the variety found on wild species with teleutospores not thickened at the top and uniformly coarsely verrucose over both cells and *T. pruni-spinosae discolor* (*T. pruni-spinosae* forma *discolor* Fischer) for the one found on the cultivated species with the wall of the apical cell frequently thickened at the top and coarsely verrucose and that of the basal cell sparsely if at all verrucose. Technical descriptions in English and the host range of the two new varieties are given.

Pittman (H. A. J.). **Leaf rust of stone fruits.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xv, 2, pp. 191–193, 2 figs., 1938.

Leaf rust (*Puccinia pruni-spinosae*) [see preceding abstract] of stone fruits does not generally attain epidemic proportions in Western Australia until rather late in the autumn, though in 1937–8 it became very

prominent in the summer and early autumn. Its chief effect is to cause premature leaf drop which towards the end of the season may render the trees prematurely dormant. In commercial orchards, however, this does not usually occur sufficiently early to cause serious under-development of the buds. In very late peach varieties the fruits may become infected and develop small broken blisters, from which the spores are released. The Goldmine variety of nectarine is often seriously infected on the leaves and fruits, especially in the wetter parts of the state. Plums are less seriously affected than peaches, nectarines, and almonds.

For control it is recommended that the trees should be sprayed shortly before leaf fall with Bordeaux mixture (6–4–40) plus calcium caseinate ($\frac{1}{2}$ lb.). All prunings should be promptly burnt. In early spring, about a fortnight before dormancy ends, the green manure crop should be ploughed under, together with any fallen leaves from the fruit trees, and the parts of the ground that cannot be ploughed should be dug. Any subsequent working of the ground should be shallow, and should be delayed as long as possible. A second spray application should be made in the early pink-bud stage. If required, further sprayings should be given at the shuck-fall stage with liquid lime-sulphur (1 in 100) plus $\frac{1}{2}$ lb. calcium caseinate per 50 gals., or dry-mix sulphur-lime, and the latter again 10 days later, two weeks after this, and finally 3 to 4 weeks before ripening. Peaches, nectarines, almonds, and plums should always be grown in very sunny situations; water should be applied only in large quantities occasionally, and the humidity of the air should be kept as low as possible.

TAGO (K.). **Studies on anthracnoses of Japanese Apricot (Prunus mume S. et Z.).**—*Forsch. PflKr., Kyoto*, iii, p. 177–208, 1 pl., 1937. [Japanese, with English summary. Received August, 1938.]

The writer describes and tabulates the results of his comparative studies on seven strains of *Gloeosporium* and *Colletotrichum* causing anthracnose of Japanese apricot (*Prunus mume*), and of fungi of the same group isolated from ripe apple, cherry, grape, plum, and *P. tomentosa* fruits. Two of the Japanese apricot strains were obtained from the green fruits, while the rest originated on the leaves, one in association with *Taphrina mume* Nishida. The Japanese apricot strains were classified as belonging to two species on the basis of their morphological differences. One species, unidentified, comprises one of the green fruit strains and one of those from the leaf and is characterized by fusiform conidia, 7 to 16 by 3 to 6 μ, is devoid of setae, and does not form perithecia in culture. The other, identified as the conidial stage of *Glomerella mume* (Hori) Hemmi is represented by four leaf strains and one strain from green fruit; it produced oblong-ellipsoid or cylindrical conidia, 8 to 19 by 4 to 8 μ, forming brown setae in the acervuli and also perithecia in culture.

In addition to the foregoing, a ripe Japanese apricot attacked by quite a different species of *Colletotrichum* was found in the Osâka market; the fungus is characterized by crescent-shaped or falcate conidia, 17 to 27 by 3 to 6 μ, and a profusion of setae. The production of perithecia was also observed on maize meal agar cultures of the apple, grape, and plum anthracnose pathogens.

All the strains under observation made the best growth at 28° C. on apricot and potato decoction and soy-bean agars, with a maximum at 36°, except in the case of the grape anthracnose fungus, which developed slightly at 40°.

In inoculation experiments on ripe apple and Japanese pear [*Pyrus japonica*] and green Japanese apricot fruits, the unidentified strain from Japanese apricot fruits was more actively pathogenic than *G. mume*, which is commonly found on the leaves. The conidia of the former species survived about 80 days in a humid condition at —10°, whereas those of *G. mume* lived for only 17 to 34. The percentage germination of dried conidia of *G. mume* at 100 per cent. relative humidity was 13·60 to 19·35, the corresponding figure for the unidentified species being 2·97 to 7·55; neither germinated at a relative humidity below 96 per cent. Under dry conditions the conidia of the latter remained viable at —10° for 319 days and those of *G. mume* for 260.

HEMMI (T.) & NIWA (S.). **On Polystictus hirsutus (Wulf.) Fr. causing wood-rot of Cherry trees.**—*Forsch. PflKr., Kyoto*, iii, pp. 336–341, 2 figs., 1937. [Japanese, with English summary. Received August, 1938.]

Specimens of cherry wood from Mt. Yoshino, Japan, rotted by *Polystictus hirsutus* [*R.A.M.*, xvi, p. 138] were abnormally soft, light, and uniformly white. The growth range of the fungus on apricot and potato decoction and soy bean agars was from 10° to 43° C., with an optimum at 34° to 35°. No development was observed at 3°, so that the agent of the wood rot of cherry trees evidently belongs to the high-temperature group of wood-destroying fungi of Humphrey and Siggers [ibid., xiii, p. 413].

HAHN (G. G.). **Blister rust susceptibility studies of naturally pollinated seedlings of the immune Viking Currant.**—*J. For.*, xxxvi, 8, pp. 737–747, 3 figs., 1938.

The writer has investigated the possibility whether susceptible seedlings originate from the variety Viking (immune from *Cronartium ribicola* [*R.A.M.*, xvi, p. 109]) growing in localities where it may perhaps interbreed with garden varieties or in localities remote from these where only self-fertilization or intercrossing between Viking bushes can take place. If susceptible seedlings arose, the growing of the Viking currant in blister rust control areas might result in the distribution of susceptible seedlings in increasing numbers within these areas. Out of 1,086 seedlings partly from Norwegian and partly from American seed taken from Viking bushes standing alone only 43 were susceptible, whilst from 749 seedlings from Norwegian and American seed taken from bushes standing near other varieties 24 proved susceptible, making a total of 67 susceptible plants (3·7 per cent.). Out of 24,908 leaves tested only 360 produced blister rust fruiting bodies. Necrotic flecks appeared on the young inoculated leaves of the immune seedlings, but neither uredo- nor teleutosori were found associated with the flecks, and the flecks did not appear on mature leaves. Generally the immune seedlings grew vigorously and produced irregularly shaped, trilobate leaves

similar to those typical for the hybrid Viking parent, which is believed to be a form of the artificially produced hybrid species, *Ribes pallidum* (*Ribes petraeum* × *R. rubrum*), having probably inherited the rust resistance from *R. rubrum*. The variety Viking is very probably closely related to, or even identical with, the Red Dutch, the only other rust-immune garden currant, as demonstrated by Tubeuf [ibid., xiii, p. 136]. Among the 45 susceptible seedlings, selected from the total of 67, of which individual records were kept, 35 plants (78 per cent.) were moderately or highly susceptible, and most of them, except for two vigorous plants, grew poorly or did not survive; the 10 remaining plants were highly resistant or almost completely immune and grew vigorously. The evidence indicates that Viking did not cross with susceptible plants in the area where the seed was gathered and the very small percentage of susceptibles obtained from the total population studied shows that only a very small percentage of Viking seedlings are heterozygous, the majority being homozygous, and rust resistance a dominant character in the parent. Furthermore, it seems that multiple factors are involved in the inheritance of resistance, accounting for the lack of uniformity in the susceptibility of the susceptible Viking seedlings.

KADOW (K. J.). **Strawberry diseases in Delaware.**—*Plant Dis. Reptr*, xxii, 10, pp. 184–186, 1938. [Mimeographed.]

Strawberry red stele disease (*Phytophthora* sp.) [*R.A.M.*, xvii, p. 401] is stated to have killed off three-quarters of the plants (Lupton and Blakemore varieties) growing on an area of nearly 2 acres in Farmington, Delaware, on land not known to have been planted to strawberries before, while in another farm in the same locality about one-half of the plants (of the same varieties) growing over an area of about 3 acres had to be ploughed under on account of the same disease, and the rest were badly affected. Two other farms in the vicinity lost about 50 and 10 per cent. of the crop, respectively, from the disease, the smaller figure representing incipient attack only. In 1937, at Bridgeville, Delaware, a grower lost 12 acres of strawberries from a disease thought to be red stele.

ROGER (L.). **Sur deux maladies des Bananiers à la Guadeloupe.** [On two Banana diseases in Guadeloupe.]—*Agron. colon.*, xxvii, 246, pp. 161–176, 1 fig., 1938.

Banana leaf spot (*Cercospora musae*) is stated to have been reported on several occasions since 1932 from Guadeloupe [*R.A.M.*, xvii, p. 191], where its prevalence appears to have increased with increase in the area planted to bananas. At present, it occurs chiefly in the north-west parts of the island, the main focus of infection being at Goyave, though some less important centres are found in the south. In Martinique the disease has been noted for a few years, but no spread occurred until the end of 1937 and the damage is much less serious.

In Guadeloupe the losses caused generally range from 25 to 50 per cent., depending on the amount and date of appearance of the spotting. In serious attacks, only two or three leaves may be unaffected in the crown. Occasionally, the stem withers, and may collapse, many tens

of hectares having been lost in this manner in December, 1937. The outbreaks have always occurred in flooded, low-lying areas, and in soils with a high water table. Even a short period of flooding weakens the plant and the suckers, and the December outbreak appears to have been brought about through simultaneous flooding and reduction in temperature. Plantations on poor quality soils also suffered severely, and the fact that the disease is less serious in Martinique may be due to the greater fertility and better quality of the soil there. The epidemic outbreak in December, 1937, was the end result of the rapid extension of banana cultivation since 1932, in many cases in unsuitable localities.

Wardlaw has suggested trying out the I.C. 2 hybrid [ibid., xvii, p. 611], but the author considers that this should only be resorted to with great circumspection. The true remedy appears to lie in the choice of the right sites and the use of improved cultural methods, including manuring, the selection of healthy cuttings, adequate spacing, proper drainage, the prompt destruction of infected leaves and, when necessary, whole plants, the establishment of a five-year rotation in badly infected areas, the avoidance of banana leaves for packing purposes, and spraying two to three weeks before the critical periods of infection (wet and cold seasons) with neutral Bordeaux mixture plus a sticker.

Moko disease (*Bacterium solanacearum*) appeared in Guadeloupe in 1936 [ibid., xvi, p. 393], following floods, and frequently occurs in association with *C. musae*, though it is present in some localities outside the area affected by *C. musae*. Infection is favoured by the same conditions that favour leaf spot; in high, dry situations attacks are rare, sporadic, and limited. The disease affects the various types of *Musa sinensis*, but, apparently, is not severe on the Congo variety, while Gros Michel and abaca [*M. textilis*] are resistant.

Parham (B. E. V.). **New Banana varieties for Fiji.**—*Agric. J. Fiji*, ix, 2, pp. 12–14, 6 figs., 1938.

Observations made in Fiji on the hybrid banana I.C. 2 developed at the Imperial College of Tropical Agriculture, Trinidad, and imported into Fiji with three other types from the same source in January 1936, showed that it has notable resistance to leaf spot (*Cercospora musae*) [see preceding abstract]. Its leaves, however, are commonly infected with rust (*Uromyces musae*) [ibid., xv, p. 165] and speckle (*Chloridium musae*) [ibid., xvi, p. 476], and it is definitely susceptible to bunchy top [ibid., xvi, p. 195], to which three of the original stools succumbed. Of the other forms imported from Trinidad 'Giant Chinese' is also susceptible to *Cercospora musae*, while Lacatan is susceptible both to this disease and bunchy top, one of three stools being completely destroyed by the latter disease.

Traub (H. T.) & Robinson (T. R.). **Improvement of subtropical fruits other than Citrus.**—*Yearb. Agric. U.S. Dep. Agric. Sep.* 1589, 77 pp. [separately numbered after p. 827], 17 figs., [1938].

In this paper (omitted from the 1937 Yearbook) [*R.A.M.*, xvii, p. 124] the authors give an exhaustive account of the work accomplished in the breeding of subtropical fruits other than citrus in the United States and other countries. Breeding against avocado scab (*Sphaceloma*

perseae) [ibid., xiv, p. 459] is stated to have been in progress in the United States for three seasons and it has been found that seedlings of the Collinson and Kellerman varieties show a relatively high percentage of resistance. In Mexico search is being made for pineapple varieties resistant to *Thielaviopsis* [*Ceratostomella*] *paradoxa*, the commonest decay organism in Mexican pineapples. Mango-breeding for disease resistance in the United States is chiefly concerned with breeding large numbers of seedlings from groves where there is the greatest likelihood of cross-pollination. These seedlings are tested for resistance to anthracnose [*Colletotrichum gloeosporioides*: ibid., xvii, p. 539], those showing resistance usually being under 1 per cent. of the total. Under Puerto Rican conditions the resistant Divine variety might well be used for crossing purposes. Apparently the irregular bearing habit of the mango in Florida is primarily due to anthracnose, though other factors may also be operative in some instances.

KONISHI (S.). **On Pestalozzia causing the fruit-rots of Loquats in the market.**—*Forsch. PflKr., Kyoto*, iii, pp. 137–146, 4 figs., 1937. [Japanese, with English summary. Received August 1938.]

Loquats (*Eriobotrya japonica*) in Kyoto markets are stated to be liable to serious damage by rots due to two distinct species of *Pestalozzia*, the symptoms of which, however, are quite indistinguishable. One appears to be identical with that described by Inouye (in an unpublished paper) as a hitherto unknown species of *Pestalozzia* on loquat leaves, characterized by fusiform, 4-septate, bi- or tri- (rarely uni-) ciliate, olivaceous conidia, 16·6 to 32·6 by 4·1 to 6·6 μ, while the other agrees with *P. funerea*, described by Hara as an agent of grey spot on the foliage of the same host. The fungi are able to pass from the leaves to the fruit in the orchard.

ROBERTSON (W. C.). **Fungicides and insecticides. Brands registered for 1938.**—*J. Dep. Agric. Vict.*, xxxvi, 6, pp. 289–300, 1938.

A list is given of approximately 400 brands of insecticides, fungicides, sheep dips, and weed-destroyers registered for 1938 at the Office of the Director of Agriculture in Victoria, under the Fungicides Act, 1935 [cf. *R.A.M.*, xvi, p. 624].

SHORROCK (R. W.). **Soil sterilization. A description of different methods.** —*J. Bd Greenkeep. Res.*, v, 18, pp. 201–210, 4 pl., 1938.

Full descriptions, illustrated by photographs and plans, are given of various soil sterilization plants used at different golf courses in England [cf. *R.A.M.*, xvii, p. 475].

GORTNER (R. A.). **Viruses—living or non-living?**—*Science*, N.S., lxxxvii, 2267, pp. 529–530, 1938.

Further arguments are presented in support of Rawlins and Takahashi's contention that the 'non-living' nature of viruses has yet to be proved [*R.A.M.*, xvi, p. 417; xvii, p. 545]. Stanley's isolation of crystalline structures [from the tobacco mosaic virus: ibid., xvii, p. 544] has been considered to disprove the possibility of 'life' in this group of organisms, but the writer visualizes the viruses as 'naked nuclei', i.e. living entities deprived of all nuclear functions except those necessary

for the formation of chromatin and cell reproduction and wholly dependent on their hosts for nutrition and the production of cytoplasm. This hypothesis would account for the 'autocatalytic' reproduction of virus 'proteins'. All the classical autocatalytic reactions known to the writer involve a tearing-down process (chain reaction) whereby energy is released, so that an entirely new type of chemical reaction must be postulated if the autocatalytic protein theory is to gain acceptance.

Dounin (M. S.) & Popova (Mme N. N.). Капельный метод анализа вирусов в растениеводстве. [The drop method of virus diagnosis in plant husbandry.]—48 pp., 1 col. pl., 15 figs. Госуд. Издат. колх.-совх. Литер. ,,Сельхозгиз". [State Publ. Off. Lit. collect. co-op. Farming 'Selkhozgiz'], Moscow, 1937. [Received June 1938.]

The authors have evolved the following serological method for the diagnosis of virus diseases [cf. *R.A.M.*, xvii, p. 630]. The serum obtained from rabbits injected with the juice of a healthy plant when mixed with the juice of a similar plant affected by a virus causes the precipitation of such antigens as are specific for healthy plants, leaving the antigens of the virus in the solution, which can easily be separated from the precipitate by centrifuging. The solution is then injected into a rabbit and the serum thus obtained is specific only for the particular virus used. When the presence of this virus needs to be determined in a plant, one drop of this serum is squeezed on to a glass slide and a drop of the juice of the plant, taken from either leaf or tuber, added to it. When the virus is present the precipitation can be seen clearly in the drop, which remains unchanged, however, when the virus is absent.

A serum can be prepared to react with a number of viruses. The presence of various viruses (including aucuba mosaic, rugose mosaic, leaf roll, virus X) was tested for in 30 potato plants of different varieties, two plants each of *Nicotiana glutinosa*, *Datura stramonium*, and tomato by both the biological and the new drop methods and the results obtained agreed in each case. For practical work on the farms the dry serum, which can be preserved for over two months, can be easily made ready for use at any time by adding a drop of water or of 0·85 per cent. salt solution.

Pasinetti (L.). **La Röntgendiagnostica applicata alla fitografia ed alla fitopatologia. Memoria I. La Röntgendiagnostica come sussidio della anatomia macroscopica normale e patologica.** [Diagnosis by means of Röntgen rays applied to phytography and phytopathology. Paper I. Diagnosis by means of Röntgen rays as an aid to normal and pathological macroscopic anatomy.]—*Riv. Pat. veg.*, xxviii, 5–6, pp. 155–191, 12 pl., 1938.

In this introductory account of his researches the author presents evidence showing that it is possible by the use of Röntgen rays to identify different families of trees from the different degrees of 'opacity' and 'absorbing power' shown by the wood, to deduce the degree of mineralization present in the tissues, and to observe the arrangement of the mineral materials. The rays revealed structural alterations in pear wood affected by pruning injury and in beech wood injured by lightning. They also showed the presence of cold storage

injury in oranges and of other physiological defects in fruits which were not visible externally [*R.A.M.*, xvii, p. 702]. Marked structural changes [which are described] were revealed in wood of *Pinus cembra* infected by a fungus, probably one of the Polyporaceae, in oak infected by *Rosellinia necatrix*, plum infected by *Fomes igniarius*, and peach infected with *Ascospora beijerinckii* [*Clasterosporium carpophilum*]. In this last instance the photographs obtained showed clearly the parasitic and toxic effect of the fungus; there was a notable reduction in accumulated material followed by histological weakness, the process resembling true demineralization. The reduced opacity of the diseased wood permitted the medullary zone to be seen. The extent of the infection could be seen in outwardly healthy wood and the method therefore may possibly be of use in selecting plants for vegetative propagation. The rays also showed dry cankers due to *Sporotrichum cactorum* in an *Echinocactus grusonii* plant, and revealed that the base of a *Malacocarpus mammulosus* plant was completely transparent owing to destruction of the tissues by a wet canker caused by *Bacterium cactivorum* [ibid., xiv, p. 765].

Pasinetti (L.) & Grancini (P.). **Ricerche sugli effetti delle 'radiazioni' su Eumiceti patogeni in funzione del coefficiente respiratorio. (Nota preliminare.)** [Researches on the effect of 'radiations' on the respiratory coefficient of pathogenic Eumycetes. (Preliminary note.)]—*Riv. Pat. veg.*, xxviii, 5–6, pp. 193–203, 1 fig., 1938.

Exposure of cultures of *Corticium rolfsii*, *Sclerotium delphinii*, and *Alternaria brassicae* grown on malt extract (25 c.c.) in Petri dishes to direct sunlight, ultra-violet rays, Röntgen rays, and radium demonstrated that the last two stimulated respiration as measured by the Haldane apparatus while sunlight and ultra-violet rays had no effect or depressed it. In general, the three organisms reacted similarly, though *S. delphinii* and *C. rolfsii* were highly susceptible to the gamma rays, while *A. brassicae* when exposed to sunlight showed marked retardation in the respiratory rate, and when exposed to the Röntgen rays and radium showed a slight increase in rate of sporulation. The biologic effect of the different radiations on all the fungi was found to be related to the quantity of energy administered and absorbed.

Köhler (E.). **Die Viruskrankheiten der Kartoffel.** [Virus diseases of the Potato.]—*Mitt. Landw., Berl.*, liii, 23, pp. 509–512, 5 figs., 1938.

This is a popular account of the symptoms of some well-known virus diseases affecting the potato crop in Germany, with directions for their control by stringent selection, establishment of seed plots in isolated sites, and especially by the extermination [by methods which are fully discussed] during the winter months of the peach aphid, *Myzus persicae*, the principal agent of transmission of these disorders.

Friedrich (H.). **Eine neue Farbreaktion zur Diagnose des Abbaugrades der Kartoffelknolle. Vorläufige Mitteilung.** [A new colour reaction for the diagnosis of the degree of degeneration of the Potato tuber. Preliminary note.]—*Phytopath. Z.*, xi, 2, pp. 202–206, 1938.

The author gives preliminary notes on a new colorimetric method of

determining the degree of degeneration of potato tubers, based on the well-known Biuret reaction for the measurement of nitrogen content. To 2 c.c. pressed juice of the tuber were added 2 c.c. N/1 potash lye and the whole well mixed with 4 c.c. of a 0·5 per cent. solution of copper sulphate in a test tube, which was then kept at room temperature for 20 hours; after this period the colour reactions did not change and the results could be recorded. The pressed juice of healthy tubers invariably exhibited a bright yellow liquid, sometimes with a dark, supernatant layer above, and accompanying this coloration a fine or dense yellow precipitate or uniform turbidity may appear. The juice of diseased tubers always gave a clear violet or light lilac-coloured liquid, in which sometimes colourless or slightly yellowish, jelly-like lumps were suspended. Further extensive testing is required before the method can be used for the practical diagnosis of diseased tubers, but it is probably fairly accurate since no obviously discrepant results have been obtained so far. No theoretical interpretation of the phenomenon can be given at present.

Kausche (G. A.). **Zur Frage der experimentellen Erzeugung einer Variante beim X-Mosaikvirus der Kartoffel.** [On the question of the experimental production of a variant of the X-mosaic virus of the Potato.]—*Naturwissenschaften*, xxvi, 23, pp. 381–382, 1938.

Purified preparations of the Cs 35 strain of potato mosaic virus X at the Biological Institute, Berlin-Dahlem [*R.A.M.*, xvii, p. 265] were found to contain a variant similar to that observed in 1937. The centrifuged sediment of the acid fraction (P_H 4) dissolved in a phosphate buffer at P_H 7·2 was active in successive dilutions of 1 in 2 down to 1 : 32,768. All steps of the concentrations at first contained the variant, some 5 per cent. of which, however, reverted to the parent strain a fortnight after the development of the primary symptoms. The residual liquid was active at P_H 4 in the same volume as the dissolved sediment down to 1 : 524,288, and here again every step of the dilution contained the variant Csx, which reverted, however, to the parent strain in a similar period to the extent of 95 per cent. Thus, the acid fractions of strain Cs 35, after ammonium sulphate precipitation, contain two variants. It is as yet uncertain whether the variant retaining its stability in the sediment originates through chemico-physical treatment as a polymerization homologue, or whether it develops from the interaction of two already existing homologous variants, one of which has undergone some injury or suffered a delay of reproductive velocity. The difference between the dilution limits of 1 : 32,768 for the sediment and 1 : 524,288 for the residual liquid, respectively, may point to the separation in the centrifuge of two variants, of which the former would have a higher molecular weight.

Pfankuch (E.) & Kausche (G. A.). **Zur Darstellung von hochgereinigtem Kartoffel-X-Virus.** [On the preparation of highly purified Potato X-virus.]—*Naturwissenschaften*, xxvi, 23, p. 382, 1938.

The isolation of the potato mosaic virus X [see preceding abstract] may be greatly simplified and accelerated, according to observations

at the Biological Institute, Berlin-Dahlem, by the immediate thorough elimination of the chlorophyll and lipoids. Instead of Bawden and Pirie's method of heating the expressed juice to 60° C. [*R.A.M.*, xvii, p. 619], which has been found to entail a substantial loss of virus, the authors make use of carbon dioxide precipitation at 0° or chloroform treatment; in either case the centrifuged solutions must be left to stand for 10 to 20 hours at a low temperature. A subsequent single half-saturation ammonium sulphate precipitation produces practically colourless, opalescent virus solutions, stated to be at least equally as pure as those secured by the English workers' technique and easier to purify still further by reason of the virtual absence of colour. A similar treatment of the expressed sap of healthy controls results in the production of absolutely clear, colourless solutions devoid of precipitable albumin.

An essentially identical method is also useful for the isolation of the tobacco mosaic virus. In both cases the nephelometric mode of determination is employed for the semi-quantitative control of the purification process. The preparations are characterized by means of their turbidity value, i.e., the extent of turbidity developing under given conditions per weight unit of protein.

STAPP (C.). **Die Schwarzbeinigkeit der Kartoffel.** [Potato blackleg.]—*Kranke Pflanze*, xv, 6, pp. 103–106, 1938.

A popular account is given of the symptoms and etiology of potato blackleg (*Bacterium phytophthorum*) [*Erwinia phytophthora*] in relation to environmental conditions in Germany [*R.A.M.*, xvi, p. 832]. Of the 38 varieties immune from wart [*Synchytrium endobioticum*] tested of recent years for their reaction to blackleg [ibid., xiv, p. 525], only Alte Daber, Flavà, and Sickingen showed any pronounced degree of resistance, though a fair capacity to withstand infection was manifested by Beseler, Rote Tiefgelbe (formerly Berolina), Konsum, Herbstgelbe (formerly Herbstgold), and Hellena. Control measures should include the use of sound, uncut tubers only, relatively shallow planting on heavy soils to facilitate respiration, fairly late planting, thorough soil aeration, immediate destruction of diseased material, procurement of seed from a fresh source if blackleg occurs on the same variety two years running, storage in a dry, cool, well ventilated place, and repeated inspections of the tubers during the winter with a view to the prompt removal of infection foci.

LEHMANN (H.). **Ein weiterer Beitrag zum Problem der physiologischen Spezialisierung von Phytophthora infestans de Bary, dem Erreger der Kartoffelkrautfäule.** [A further contribution to the problem of physiological specialization of *Phytophthora infestans* de Bary, the causal agent of Potato blight.]—*Phytopath. Z.*, xi, 2, pp. 121–154, 12 figs., 1938.

In his study on *Phytophthora infestans* on potato [*R.A.M.*, xvi, p. 403] the author demonstrated the typical and constant differences in the pathogenicity of the eight biotypes of the fungus, isolated in the summer of 1936 at Müncheberg, on a test assortment of 50 hybrids between *Solanum demissum utile* and *S. tuberosum*. According to their reaction to the races [as indicated in a table] the test clones can be

classified into 17 groups. Race 1, which proved to be the most generally distributed race in German fields, was the least virulent and attacked only 2 out of 50 test clones, while the most virulent race 8 attacked 47 vigorously and the remaining 3 weakly. Measurements of the sporangia of the eight races did not yield any uniform results but showed that the well-known variability of form and size of the sporangia in species of *Phytophthora* is very marked in *P. infestans*; clearly defined morphological differences between the eight races could not be detected. In infection experiments with the eight races on 30 varieties of cultivated potatoes no specialization between races and varieties was observed apart from an apparently greater susceptibility of tubers to race 1. The leaf infections showed no measurable differences, but the tubers of early potatoes were generally more susceptible than those of the late varieties. The clones of the test assortment, on the other hand, showed a very precise specialization of certain races on the foliage and tubers of certain clones, but no correlation between disease resistance and early or late maturity appeared to exist in the test clones. The discovery of the particularly virulent races Nos. 5 to 8 is stated to have considerably reduced the number of resistant wild varieties which could have been used in breeding resistant varieties of potatoes, and the necessity is stressed of selecting material from still larger and more complete collections of wild forms.

Corky scab in Otway. Minister's successful measures at eradication.—*J. Dep. Agric. Vict.*, xxxvi, 6, pp. 301–302, 1938.

Rapid progress is being made in the eradication of potato corky scab [*Spongospora subterranea*] from those parts of Beech Forest, Victoria, where the disease was found in June, 1936 [*R.A.M.*, xvi, p. 118]; on that date, infection was present on 28 farms and 222 acres, whereas on 23rd April, 1938, only 4 farms and 43 acres were affected. Arrangements were made in 1936 for growers whose crops were affected to sell their clean potatoes to Government institutions, where the peelings could be burnt. Small potatoes from the affected areas were not allowed to be sold for seed or used in clean districts. Growers were advised not to plant infected fields with potatoes for a time, and it was suggested that those areas should be sown down to pasture, the Department of Agriculture providing seed, manure, and advice.

Leach (J. G.), Krantz (F. A.), Decker (P.), & Mattson (H.). **The measurement and inheritance of scab resistance in selfed and hybrid progenies of Potatoes.**—*J. agric. Res.*, lvi, 11, pp. 843–853, 1 fig., 1938.

In testing the resistance to scab (*Actinomyces scabies*) [*R.A.M.*, xvii, pp. 413, 483] of 33 selfed lines and 27 crosses of potato in Minnesota, the authors on harvesting the crop gave each individual tuber a rating of 0, 1, 2, 3, or 4 (ranging from no lesions to large ones), and a scab rating for each hill was obtained by multiplying the number of tubers in each class by the number of the class and dividing the product by the total number of tubers in the hill. The scab rating for a seedling family was obtained by averaging the ratings of the individual hills. Four methods of classifying the material were used: (1) including ratings

of all tubers regardless of size, (2) including only ratings of the tubers larger than 1 in. diameter, (3) giving each hill a rating corresponding to the most susceptible type lesion found on any tuber of the hill, and (4) rating each hill into one of the five classes on the basis of the predominant type of scab lesion among all the tubers of the hill. The data obtained by these four methods of classification are presented and show that significant differences in scab susceptibility were revealed by all four methods but (1) was most effective, closely followed by (2). Method (3) gave significant differences between families whereas (4) proved unsatisfactory. In further statistical analyses the four methods maintained their same relative position as regards effectiveness.

The hereditary nature of differences in scab resistance was shown by grouping together those hybrid families with a common parent and comparing the variance of scab ratings between and within the groups. Data from 37 hybrid families grouped in 12 groups showed significant differences between the groups and indicated the relative breeding value of the common parents, the variety Jubel and the selection 5–14–8–1 having a high breeding value. Eight F_1 families having 5–10–1 as a common parent showed significant differences in scab resistance indicating differences in the unrelated parents in their ability to transmit resistance. A comparison of ten selfed lines showed wider differences to exist between the selfed lines than between their hybrid progenies. Crosses between susceptible parents gave a significantly higher mean scab rating than crosses of susceptible with resistant parents; crosses between intermediates and of intermediate with resistant parents gave a significantly lower mean scab rating still, and crosses between resistant parents the lowest rating of all.

Abe (T.). **On the relation of susceptibility of different portions of the Rice-plant to the blast fungus Piricularia oryzae Br. et Cav.**—*Forsch. PflKr., Kyoto*, iii, pp. 115–136, 1 pl., 1937. [Japanese, with English summary. Received August, 1938.]

Both under natural and experimental conditions the maximum number of blast (*Piricularia oryzae*) spots on rice [*R.A.M.*, xvii, p. 622] seedlings occurred towards the centre of the medium-sized leaves. The height of mature plants, the length of the spikes and their pedicels, and the weight of the spikes showed a tendency to diminish in proportion to the severity of the disease. The spikelets were the organs most liable to infection in mature plants, followed by the haulm (first internode) and spike pedicel internode, and the maximum reduction in kernel yield resulted from the invasion of all parts of the spike pedicels and the second internode of the haulm by the fungus.

Aoki (K.). **Physiological studies on the conidial germination of Piricularia oryzae and Ophiobolus miyabeanus.**—*Forsch. PflKr., Kyoto*, iii, pp. 147–176, 1 diag., 8 graphs, 1937. [Japanese, with English summary. Received August, 1938.]

Conidial germination in the rice pathogens, *Piricularia oryzae* [see preceding abstract] and *Ophiobolus miyabeanus* [*R.A.M.*, xvii, pp. 343, 699], was shown by the writer's experiments to be suppressed in an atmosphere containing an insufficiency of oxygen, the check to development

occurring at or above 50 per cent. oxygen absorption from ordinary air in the case of *O. miyabeanus* and at 10 per cent. in that of *P. oryzae*. The latter germinated better at an atmospheric content of 5 to 30 per cent. carbon dioxide than in air deprived of the same percentage of oxygen. Although a proportion of the conidia of *O. miyabeanus* germinated in an oxygen-free atmosphere as well as in one containing 100 per cent. carbon dioxide, no growth was made by *P. oryzae* under comparable conditions. The presence in the atmosphere of 50 to 70 per cent. carbon dioxide induced structural abnormalities in the germ-tubes of both fungi. Excess of oxygen slightly inhibited conidial germination in both organisms. The development of conidia of *P. oryzae* was arrested by contact with those of *O. miyabeanus*, but the latter did not suffer from the proximity of the former.

The conidia of *O. miyabeanus* germinate through a wider range of hydrogen-ion concentrations than those of *P. oryzae*, which develops better at P_H 5 to 6 and 8 to 9 than in a medium adjusted to neutrality. Mycelial growth in the latter fungus is almost equally abundant at P_H 4·6 and 9·6, so that vegetative development and conidial germinability are evidently distinct phenomena. The hydrogen-ion concentration chiefly affects germ-tube length rather than the percentage of germination in both fungi.

In tests to determine the effect on *O. miyabeanus* and *P. oryzae* of variations in the osmotic pressure of the medium by the addition of glucose or glycerine, both organisms germinated almost equally well in solutions from 0·1 to 1·0 mol with a slight tendency to an increase in the germination percentage and germ-tube length with rising pressure. In a 2 mols solution (50 atmospheric pressures) there was a rapid decline in germination and at 3 mols the fungi made only scanty growth.

HEMMI (T.). **On cereal diseases in Japan.**—*Forsch. PflKr., Kyoto*, iii, pp. 1–17, 1937. [Received August, 1938.]

A tabulated list is given of some common cereal diseases in Japan, followed by a discussion of certain aspects of rice blast (*Piricularia oryzae*) [see preceding abstracts], stripe and dwarf [ibid., xvii, p. 552], and 'bakanae' disease (*Gibberella fujikuroi*) [ibid., xv, p. 173; xvii, p. 699]. Most of the information herein presented has already been noticed in this *Review* from other sources, but it is of interest to record the recent discovery by Kuribayashi (published in Japanese) that the widespread and destructive stripe disease of rice in the Nagano district of Japan is due to a virus transmissible in 12 to 46 days by the insect *Delphacodes steriatellus* (*J. Pl. Prot.*, xviii, 1931). The symptoms of the trouble, which affects both the paddy and upland types of rice, include torsion, abnormal elongation, and drooping of the young leaves, which are narrow and of a pale colour, with one or more yellowish-green or yellowish-white stripes running parallel with the midrib, and emptiness or absence of ears.

KIMURA (K.). **On the relation of fungi to discoloured Rice seeds.**—*Forsch. PflKr., Kyoto*, iii, pp. 209–233, 1 col. pl., 1 fig., 1937. [Japanese, with English summary. Received August, 1938.]

The following fungi were isolated from rice grains affected by various

types of discoloration in the neighbourhood of Kyoto, Japan: *Phoma glumarum* [*R.A.M.*, xiii, p. 652], *Ophiobolus miyabeanus*, *Alternaria oryzae* [ibid., xiv, p. 653], *Epicoccum hyalopes* Miyake, and *Gibberella saubinetii* [ibid., xvi, p. 384]. Similar effects were produced by the inoculation of rice grains with *P. glumarum*, *O. miyabeanus*, *A. oryzae*, *E. hyalopes*, *Brachysporium oryzae* [ibid., xiii, p. 653], *G. fujikuroi* [see preceding abstract], and *Fusarium* spp., before, during, and after the flowering period of the plants, the fungi being most virulent when introduced before flowering and least so after its completion. The highest degree of pathogenicity was manifested by *O. miyabeanus*, followed in descending order by *G. fujikuroi*, *F.* sp., *B. oryzae*, *P. glumarum*, *E. hyalopes*, and *A. oryzae*. Each of the ten types of discoloration recognized appeared to be caused by a certain fungus or by several fungi together.

SETO (F.). **Studies on the 'bakanae' disease of the Rice plant. V. On the mode of infection of Rice by Gibberella fujikuroi (Saw.) Wr. in the flowering period and its relation to the occurrence of the so-called 'bakanae' seedlings.**—*Forsch. PflKr., Kyoto*, iii, pp. 43–57, 2 diags., 1937. [Japanese, with English summary. Received August, 1938.]

During 1933–4 the writer continued his experimental studies in the Kyoto district of Japan on the mode of infection of rice by *Gibberella fujikuroi* [see preceding and next abstracts] during the flowering period [*R.A.M.*, xv, p. 173]. In inoculation tests by spraying conidial suspensions of the fungus on healthy rice heads, infection was found to take place not only during or immediately after flowering, but at any time within the ensuing three weeks. Over 74 per cent. of the kernels in the series of plants inoculated at flowering time during the two years of the trials contracted the 'bakanae' disease, whereas in those inoculated in the early stages of kernel development the percentage ranged only from 21 to 40 per cent. Inoculations of the rachis and branches were sometimes successful, the average percentage of branch infection at different times being 17·53. Rice seedlings are invaded in the early stages of growth by the 'bakanae' fungus, which becomes systemic within the plant but does not usually penetrate the floral parts. The culm surfaces of badly diseased plants frequently bear sporodochia, which are the principal source of inoculum for floral infection.

IMURA (J.). **On the alcoholic fermentation of Gibberella fujikuroi, the causal fungus of the 'bakanae' disease of the Rice plant and its relation to pathogenicity.**—*Forsch. PflKr., Kyoto*, iii, pp. 289–309, 1937. [Japanese, with English summary. Received August, 1938.]

Fermentative activity, determined by the volume of carbon dioxide produced by the mycelia of 14 strains of *Gibberella fujikuroi*, the agent of 'bakanae' disease of rice [see preceding abstracts], on a peptone-salt solution plus 5 per cent. glucose, was found to vary among the different strains, the intensity of anaerobic respiration in the strongest during a 15-day period being three times as great as in the weakest. No definite correlation could be detected between fermentative activity and pathogenicity to rice seedlings, but there was a tendency for the strains with

weak fermentative activity and strong pathogenicity to grow more vigorously under aerobic conditions than those with a pronounced capacity for fermentation.

MURRAY (R. K. S.). **Report of Botanist and Mycologist for 1937.**—*Rep. Rubb. Res. Bd, Ceylon, 1937*, pp. 22–33, 1938.

During 1937, owing to late wintering in the low-lying districts, infection of *Hevea* rubber in Ceylon by *Oidium* leaf disease [*O. heveae*: *R.A.M.*, xvi, p. 709] was mild, though in areas where sulphur dusting was not carried out the latest-wintering trees became severely defoliated. At high elevations the disease was as prevalent as in previous years.

Numerous outbreaks of root disease, usually associated with *Fomes lignosus* or *Poria hypobrunnea* [ibid., xvii, p. 624], occurred in replanted clearings. In every case investigated the source of infection by *F. lignosus* was traced to an old rubber root, demonstrating that the fungus was present before the old trees were removed, but was not doing enough damage to give any visible indication of its presence above ground. When an infected tree is felled and the roots are left in the ground, the balance between fungus and host is disturbed, and the former begins to grow actively. *P. hypobrunnea* is extremely rare as a cause of root disease in old rubber, and its prevalence in new clearings suggests that young plants are much more susceptible to infection than mature trees.

VERGOVSKY (V. I.) & VODOLAGHIN (V. D.). Вредители и болезни эфирномасличных растений и борьба с ними. [Pests and diseases of essential oil plants and their control.]—116 pp., 86 figs., Всесоюзн. научно-исслед. Инст. эфирномасл. пром. ,,ВИЭМП''. [Pan-Soviet sci. Res. Inst. essent. Oil Ind. 'VIEMP'], 1938.

This is a practical handbook dealing with the symptoms and the control of pests and diseases of essential oil plants occurring in U.S.S.R. The chief disease of coriander [*Coriandrum sativum*] and anise [*Pimpinella anisum*] is a blackening and deformation of the fruit, resulting in a decrease of the yield. The etiology of the disease is obscure. Affected coriander seeds lose their germinability almost completely, while the germinability of anise is decreased by 30 to 50 per cent. The disease occurs in all districts where the plants are grown, the percentage of infected seed in the Voronezh district usually varying between 1 and 20 per cent., but rising in some years (e.g., 1937) to 50 per cent. or more. Witches' broom usually affects up to 3 per cent. of coriander and anise plants grown in the Voronezh district, the diseased plants forming no fruit. *Erysiphe umbelliferarum* occurs on anise in all districts but develops only to a very slight extent in dry years. For the general control of diseases of coriander and anise it is recommended to use clean seed, to sow the new crop as far as possible from land cropped in the previous year, to sow early, to remove and to destroy plant debris and straw, and to apply hot-water treatment to the seeds (pre-soaking for 8 to 12 or even only 3 hours and steeping in hot water at 50° C. for 15 to 20 minutes).

The root rot of thyme [*Thymus vulgaris*] due to *Fusarium* sp. usually forms several centres of infection in the field causing the bare patches. Disinfection of the patches is advised, together with a peripheral zone

at least 0·5 to 1 m. wide, with bleaching powder applied at a rate of 100 to 200 gm. per sq. m.

The chief disease of fennel [*Foeniculum vulgare*] is caused by *Cercospora depressa*, which attacks the leaves, stems, and seeds, causing the seed to shrink and fall. In some years the seed losses in the forest-steppe belt of the Ukraine amount to 50 per cent. or more, and the oil yield of infected seeds is reduced by 15 per cent. *C. depressa* develops in the early summer and both infection and fructification occur only in presence of dew. In the autumn the conidia of *C. depressa* cease to form, but pycnidia of *Phoma anethi* are then found to be present. The *Cercospora* disease develops in the following spring from infected seeds and plant debris and is also spread from *Anethum graveolens*. *Alternaria tenuis* forms a black mould on the surface of the fennel seeds. Hot-water treatment of the seeds is recommended in the control of fennel diseases (pre-soaking for 15 to 18 hours at 17 to 20° and steeping in hot water at 53° for 10 minutes).

Peppermint [*Mentha piperita*] rust (*Puccinia menthae*) [*R.A.M.*, xvi, p. 87; xvii, p. 6] causes an annual loss of about 25 per cent. of the leaves or even 50 per cent. and more in wet years, decreases the oil yield by 16 to 23 per cent., and lowers the quality of the oil by reducing the menthol content. Peppermint No. 541 is the most resistant to rust and contains up to 5 per cent. oil with a high menthol content. The 'white ryaboukha' disease of peppermint, the origin of which remains unknown, has considerably increased during the last few years. It appears in May or June in form of dark, small spots on the leaves, stalks, and stems of the plants and leads to premature leaf fall and to a general debility of the plant. The powdery mildew of peppermint (*Erysiphe cichoracearum* f. *menthae* Jacz.) occurs in all districts, but in the Ukraine usually in a very mild form. In the control of peppermint diseases the use of clean planting material is recommended together with spraying with 1 per cent. Bordeaux mixture soon after emergence and three times more at intervals of 15 days.

Rose rust (*Phragmidium subcorticium*) [*P. mucronatum*: ibid., xvii, p. 459] attacks *Rosa damascena* and *R. alba*, but not *R. gallica*. *Sphaerotheca pannosa* var. *rosae* [loc. cit.] attacks ornamental roses, *R. canina*, and *R. gallica*, but affects *R. damascena* only slightly. During the last three or four years a stem wilt of roses (caused by a species of *Fusarium*) resulting in the ultimate death of the plants has considerably increased in the Crimea. *R. gallica* was most severely infected, especially on plots where vegetables such as potatoes or tomatoes had been previously grown.

Geranium [? *Pelargonium*] cuttings in hot-beds are affected by species of *Botrytis* [ibid., xvi, p. 43], *Graphium*, and *Dendrodochium*, by leaf spots caused by species of *Macrosporium* [cf. ibid., xvi, p. 537], *Ramularia*, *Didymaria*, *Botryosporium*, and *Haplographium*, and by leaf bacteriosis. In the field the geranium plant is attacked by black root rot due apparently to bacteria, and by brown root rot (*Hypholoma velutinum*), characterized by rapid withering of the plants and chiefly occurring on fields newly cleared from forest trees. For the control of geranium diseases the following measures are recommended: crop rotation, removal of tree debris in newly cleared fields, disinfection of cuttings prior to planting in the hot-beds in a 0·1 per cent. solution of

potassium permanganate for 2 to 3 seconds, and disinfection of the soil of hot-beds with a 1 per cent. solution of iron sulphate applied at a rate of 5 l. per sq. m. 10 to 15 days prior to planting.

A destructive disease of sage [*Salvia officinalis*], apparently of bacterial origin, causing hollowness of roots, occurs in the Krasnodar region and the Crimea. It is recommended that sage be planted as far away as possible from old sage fields, as it was observed that over 50 per cent. of the plants were destroyed in plots situated next to old sage plots. The same precaution should be taken for the control of leaf spot diseases of sage caused by *Ovularia ovata* and *Septoria salviae* var. *sclarea*. Other diseases of sage are caused by *Peronospora swinglei* and *Erysiphe labiatarum* Chev. f. *salviae* Jacz.

Septoria lavandulae [ibid., xvii, p. 71] is widespread on lavender in the Caucasus and in the Crimea but so far has not caused commercially appreciable losses, as severe attacks only occur very rarely. *Phoma lavandulae* [ibid., xi, p. 375] occurs on lavender in the Crimea and a wilt disease of undetermined origin [cf. ibid., xiii, p. 98] in the Caucasus, the Krasnodar region, and in a particularly severe form on the south coast of the Crimea.

Bureau of Sugar Experiment Stations. Fiji disease in the Bundaberg district.—Fiji disease in the Isis district. P.O.J. 2878 in the Mackay areas.—*Aust. Sug. J.*, xxx, 3, pp. 162–163, 1938.

Attention is once more urgently directed to the need for the immediate notification of fresh cases of Fiji disease in the sugar-cane plantations of the Bundaberg and Isis districts of Queensland [*R.A.M.*, xvii, p. 627], and for the prompt eradication of infected stools.

The recent decision of the Bureau of Sugar Experiment Stations to disapprove the further planting of P.O.J. 2878 in certain parts of the Mackay areas on account of its susceptibility to downy mildew [*Sclerospora sacchari*: loc. cit.] having evoked strong criticism among growers, a statement by the Director, Dr. Kerr, to the *Mackay Mercury* defending this action is reproduced. The resolution of the authorities was based on expert knowledge of the danger to the industry involved in allowing an apparently minor disease to proceed unchecked on a susceptible variety, and had been taken in the best interests of the growers. Suitable substitutes for P.O.J. 2878 in the affected areas are 2714, 2725, and Co. 290, while a new variety bred at the Mackay station, Q. 20, also merits further trials.

Clinton (G. P.) & Zundel (G. L.). **Notes on some Ustilaginales from India.**—*Mycologia*, xxx, 3, pp. 280–281, 1938.

This list of 11 species of smuts collected in India by R. R. and I. D. Stewart and identified by the senior author in 1926–7 includes *Urocystis magica* Pass. on *Allium rubellum*.

Petch (T.). **British Hypocreales.**—*Trans. Brit. mycol. Soc.*, xxi, 3–4, pp. 243–305, 39 figs., 1938.

This is a complete, descriptive monograph [with Latin diagnoses in the case of two new species] of British Hypocreales, with a key to the genera and an index to the species. It contains 124 species distributed

in 41 genera, grouped in the two families Nectriaceae and Hypocreaceae, and is the first complete account of these fungi published since Cooke's 'Handbook of British Fungi' appeared in 1871, in which 56 species were enumerated.

NANNIZZI (A.). **Contributo alla flora micologica della Bulgaria: Micromiceti del circondario di Kazanlik, Balcani centrali.** [A contribution to the mycological flora of Bulgaria: micromycetes of the district of Kazanlik, central Balkans.]—*Atti Accad. Fisiocr. Siena*, Sez. agr., v, pp. 33–41, 1938. [Abs. in *Riv. Pat. veg.*, xxviii, 5–6, p. 213, 1938.]

A list is given of 87 species of fungi, including saprophytes, found on wild and cultivated plants in the vicinity of Kazanlik, Bulgaria, including *Septoria moesiaca* n.sp., attacking the leaves of *Atropa belladonna*. In wet seasons, considerable damage is caused to roses by *Phragmidium subcorticium* [*P. mucronatum*; see above, p. 771]. The list also includes *Ramularia foeniculi*, described by Sibilia on cultivated fennel [*Foeniculum vulgare*] in Italy [*R.A.M.*, xii, p. 244].

HILBORN (M. T.) & MARKIN (FLORENCE L.). **List of causes of fungous and bacterial plant diseases in Maine to 1936 inclusive.**—*Plant Dis. Reptr, Suppl.* 105, 60 pp., 1 map, 1938. [Mimeographed.]

This list of plant diseases recorded in Maine up to the end of 1936 comprises 730 pathogens and 371 hosts.

RICK (J.). **Resupinati riograndenses.** [Resupinate fungi of the Rio Grande.]—*Broteria*, vii, 2, pp. 71–77, 1938.

Latin diagnoses are given of 18 resupinate fungi collected by the author in the Rio Grande Valley, Brazil; all the species except one are new and two new genera, *Basidiodendron* and *Gloeoasterostroma*, are erected.

GIGANTE (R.). **Il mosaico del Tabacco.** [Tobacco mosaic.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 1, pp. 93–130, 1 pl., 15 figs., 1938.

In 1937, a number of tobacco plants in pots, which had been kept in a greenhouse in Italy completely isolated from insects, were placed (still in pots) in the open, and after one month two showed symptoms of a mosaic disease characterized by variegated, rugose, and ribbon-like or even filiform leaves. Intracellular bodies 3 to 12 μ in diameter were present in the epidermal and mesophyll cells and in the leaf hairs. Inoculations of healthy tobacco, tomato, chilli, and eggplant by rubbing the leaves with juice expressed from the infected leaves, and by allowing *Macrosiphum gei* [*M. solanifolii*] taken from the diseased tobacco plants to feed on them, gave positive results, and it is considered that under local conditions this insect is probably the vector. From the symptoms produced in the different plants and the histological effects on the tissues, the author concludes that the mosaic in question is ordinary tobacco mosaic, due to Johnson's tobacco virus 1. The paper concludes with recommendations for control based on improved cultural practices, the prevention of spread on implements, workers' hands, and the like, and the suppression of the insect vector.

LEVYKH (P. M.). Вредоносность черной корневой гнили Табака. [The injuriousness of black root rot of Tobacco.]—Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна (ВИТИМ). [*The A. I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], Krasnodar, *Publ.* 135, pp. 23–30, 1938. [English summary.]

In a series of studies from 1933 to 1935 the author evolved a method of calculating the coefficient of injuriousness of black root rot of tobacco, caused by *Thielaviopsis basicola* [see next abstract]. Six hundred tobacco plants [variety unspecified] were planted in plots naturally infected with *T. basicola*; at harvest the yield records were taken from each plant separately and then the plants were pulled up and the percentage of infection recorded. It was thus found that no decrease of yield resulted when 10 per cent. of roots were infected; whereas infection percentages of 15 to 35, 45 to 65, and 70 to 100 corresponded with decreases in yield of 15, 30, and 53·2 per cent., respectively. In another experiment the mean degree of infection was found to be 60·4 per cent. and the mean decrease of yield 49·4 per cent. Correlating these two figures the coefficient of injuriousness is calculated as the percentage decrease of yield corresponding to 1 per cent. of the mean infection and was found to be equal to 0·81 (i.e. 49·4/60·4). Estimation of the decrease in yield from the coefficient of injuriousness and the mean per cent. infection proved to be almost accurate for plots with a low degree of infection, whereas in highly infected plots the figures were higher by about 10 per cent. than the actual yield records. It is suggested as an explanation that above 70 per cent. infection the yield is not further decreased. At the same degree of infection the decrease of yield varies considerably with the variety of tobacco and slightly with the type of soil. The coefficient of injuriousness was found to be 0·82 for the variety Trebizond 1272, 0·65 for Trebizond 649, and 0·44 for Trebizond 1705.

KOCH (L. W.) & HASLAM (R. J.). **Varietal susceptibility of Tobacco to brown root-rot in Canada.**—*Sci. Agric.*, xviii, 10, pp. 561–567, 2 pl., 1 diag., 1938.

During 1936, in a plot in Ontario originally designed to compare the morphological characters of 16 flue-cured tobacco varieties, brown root rot [*R.A.M.*, xvii, p. 560] developed soon after transplanting, and consistent differences in varietal reaction to the disease were noted. In 1937 further tests of the varietal susceptibility of both flue-cured and Burley varieties were carried out. It was found that on selected areas of the lighter tobacco soils the disease could be expected to develop with reasonable certainty, provided one or more maize crops preceded the tobacco, and it was on such plots the trials were made. Both the circumstances in which the disease develops in Ontario and its symptoms strongly indicate that it is similar to the disease in Connecticut [ibid., xvi, p. 67].

The results obtained [which are tabulated and discussed] showed extreme susceptibility in the flue-cured varieties Yellow Mammoth and White Stem Willow Leaf, and much resistance in White Mammoth,

Bonanza, White Stem Orinoco, and Duquesne, while certain other varieties were not entirely consistent in their reaction. Among the Burley varieties Harrow Velvet, Gay's Yellow, and Halley's Special were highly susceptible, and Judy's Pride and Kelley markedly resistant. Harrow Velvet, it is pointed out, is conspicuously resistant to black root rot [*Thielaviopsis basicola*: ibid., xvii, p. 560], while Judy's Pride and Kelley are extremely susceptible to it. These results, though only preliminary, are considered to indicate a promising means of control of the disease.

PARK (M.) & FERNANDO (M.). **Some studies on Tobacco diseases in Ceylon. III. The effect of the time of spraying and of the nature of the fungicide on the control of frog-eye (Cercospora nicotianae E. & E.). IV. The economics of field spraying for the control of frog-eye (Cercospora nicotianae E. & E.).**—*Trop. Agriculturist*, xc, 6, pp. 323–340, 3 figs.; pp. 341–347, 2 figs., 1938.

In further experiments on the frog eye disease of tobacco caused by *Cercospora nicotianae* [*R.A.M.*, xvi, p. 713] plots of Harrison's Special tobacco at the Ganewatta Experiment Station were sprayed with various fungicides at four different dates, viz., January 13th, 20th, 27th, and February 3rd, 1938. The plants were primed two weeks before the first spraying and topped for the first time on the day of the second spraying and subsequently at weekly intervals; the leaves were harvested from February 15th to February 22nd. A survey of yield records revealed that spraying on January 27th gave the best results, spraying on January 20th and February 3rd came second, and spraying on January 13th was the least effective. All of the fungicides used lessened the amount of infection in comparison with the unsprayed control; they ranged in the following order of efficiency: (*a*) proprietary colloidal copper 4 oz., proprietary spreader ¼ oz., water 4 gals.; (*b*) copper sulphate 2½ oz., soft soap 13 oz., 66 per cent. ammonia 1 oz., water 4 gals.; (*c*) copper sulphate 2½ oz., soft soap 16 oz., water 4 gals.; (*d*) proprietary colloidal copper 2 oz., proprietary spreader ¼ oz., water 4 gals.; (*e*) proprietary colloidal copper 1 oz., proprietary spreader ¼ oz., water 4 gals. The increases in yield over the unsprayed control were 230, 208, 190, 161, and 136 lb. cured leaf per acre, respectively. Since the fungicide (*a*) has the same copper content as (*b*) and (*c*), the better results obtained with it are ascribed to its wetting and adhesive properties and the degree of subdivision of its particles. In the light of the results obtained the optimum time for spraying appears to be determined by the rate of expansion of leaf surface and the drift of infection. Spraying during a period of rapid expansion is of little value and should be delayed until growth has diminished, the factor limiting this delay being the increase in the volume of infection. The incubation period of frog eye lesions being eleven days, it is assumed that most of the infections took place just after the spraying on January 27th, since the number of frog eye lesions was still very small on February 10th but very high on February 14th. The spraying of January 27th gave the best results, because at this date the leaves of the plants had expanded nearly to their maximum and the level of infection was at its minimum. The symptom picture curves indicate that two sprayings at intervals

of about a fortnight would give better control than a single spraying, while more than two sprayings are unlikely to give additional control.

The economic aspect of field spraying was investigated at the Wariyapola Experiment Station in 1938 on a field of Harrison's Special tobacco, about 16 gals. of spray (*a*) being used for about 300 plants. Assessing the cost of spray materials at Rs. 17·26 per acre, labour (7 men at 45 cents a day each) at Rs. 3·15 per acre, depreciation of the sprayer at Rs. 10 per acre, and adding charges for supervision and minor repairs, the cost of spraying is calculated as Rs. 35 per acre. The sprayed plants yielded 193·6 lb. grade I flue-cured tobacco per acre as compared with 54·4 lb. in the unsprayed control, the difference in value amounting thus to about Rs. 140 per acre. The substitution for the proprietary colloidal copper of two home-made copper sprays reduced the cost of spray materials to Rs. 8·71 and Rs. 7·44 per acre, but they were both less effective and caused a certain amount of spray injury.

WICKENS (G. M.). **Plant pathology.** *ex* **Report of the Tobacco Research Board for the year ending December 31st, 1937 (continued).**—*Rhod. agric. J.*, xxxv, 6, pp. 424–431, 1938.

In this report [*R.A.M.*, xvii, p. 708] the following leaf spot diseases of tobacco are stated to have occurred on the Station during the season under review. Frog eye [*Cercospora nicotianae*: see preceding abstract] was generally prevalent and was not appreciably controlled by spraying or dusting, the spread of infection being much more simply and cheaply checked by priming off and destroying the small first leaves, which are commercially valueless, before they develop frog eye spots, and by reaping the following leaves at a stage of maturity, at which they are sufficiently advanced to be cured but show only negligible frog eye infestation and come out of the barn relatively clean. Although the more frequent reaping involves more labour and more barn accommodation, the increased cost is considered to be many times outweighed by the enhanced value of the crop. *Alternaria* leaf spot [*A. longipes*: ibid., xii, p. 748; xvii, p. 490] occurred generally but caused only slight infection. Two very small outbreaks of angular spot [*Bacterium angulatum*: ibid., xvi, p. 2] occurred early in January, but the disease did not spread after affected leaves were removed. Spraying with Bordeaux mixture or dusting is recommended for the control of both the *Alternaria* and angular leaf spots, especially in districts where the soil is heavy and these diseases may assume a serious epidemic form; in addition a regular routine of spraying or dusting of the seed-beds is advised. In spite of thorough application of the usual precautionary measures against mosaic (frequent washing of the hands and separate pruning of diseased and healthy plants) and careful avoidance of all known sources of infection, the disease is stated to have occurred to a considerable degree, and it is concluded either that these measures are not sufficiently efficient or that there are some sources of infection and means of spread of the disease which these measures fail to control. It is, therefore, essential to know these sources before complete control measures can be worked out applicable under Rhodesian conditions.

SHARP (A.). **Experiments with Tobacco seed-bed covers at Manjimup (1937).**—*J. Dep. Agric. W. Aust.*, Ser. 2, xv, 2, pp. 248–251, 4 figs., 1938.

In further tests carried out in Western Australia in 1937 with various types of covers for use on tobacco seed-beds treated with benzol against downy mildew [*Peronospora tabacina*: *R.A.M.*, xvi, p. 284; xvii, p. 211] windowlite was the most satisfactory as regards seedling growth, closely followed by unbleached calico, washed to removed the dressing, and treated with raw or boiled linseed oil; growth under the control covers (unbleached calico treated with a mixture of paraffin wax, petroleum jelly, boiled linseed oil, and mineral turpentine) was definitely slower. The windowlite appeared to be as good as new at the end of the season, whereas the linseed-oil calico covers were unfit for further use. The control covers are expected to prove serviceable for one more season at least.

VAN DER MEER MOHR (J. C.). **Verslag van het Deli Proefstation over het jaar 1937.** [Report of the Deli Experiment Station for the year 1937.]—*Meded. Deli-Proefst.*, Ser. 2, c, 44 pp., 1938.

Much of the phytopathological work described in this report [cf. *R.A.M.*, xvii, p. 416] has already been noticed from another source [ibid., xvii, p. 632], but the following may be mentioned. The terms 'pseudo-mosaic' or 'false peh-sim' will in future be used to designate an obscure group of tobacco diseases having nothing in common with true mosaic but foliar mottling. Unlike true mosaic, pseudo-mosaic is not transmissible by direct contact, though it can be conveyed by grafting and possibly spread by means of insects. These disorders have definitely been on the increase in recent years.

A substantial reduction in the incidence of 'wet stalks' [ibid., xvi, p. 414] was secured by liberal applications of lime, which resulted, however, in an undesirable hardening of the plants; this was corrected by the admixture of tobacco ash with the lime.

WHITE (H. L.). **Further observations of the incidence of blotchy ripening of the Tomato.**—*Ann. appl. Biol.*, xxv, 3, pp. 544–557, 7 graphs, 1938.

The statistical study of the records over a number of years at the Cheshunt Experimental Station showed that the annual fluctuation in the percentage of tomato fruits affected with blotchy ripening [*R.A.M.*, xv, p. 539] on potassium-deficient and nitrogen-deficient plots showed a significant negative correlation with the mean daily number of hours of bright sunshine between 1st April and 31st August. On the potassium-deficient plots the weight of fruit produced was increased and the percentage of blotchy fruit reduced either by raising the potassium supply or by increasing the light factor. The beneficial effect of increased light on the crop of the potassium-deficient plants was much greater than any corresponding effect on the yield of the nitrogen-deficient or completely manured tomato plants. These results suggest that blotchy ripening is not due directly to lack of potassium or nitrogen but to metabolic disturbances that are counteracted by

increase in light. Since acceleration of blossoming and prolongation of ripening are associated with potassium deficiency, and also with low carbohydrate level, irrespective of the potassium supply, the beneficial effect of light on the fruit of potassium-deficient plants is attributable to increase in carbohydrate level. Furthermore, accumulation of carbohydrate in the leaves of potassium-deficient plants was indicated by the continued increase in the dry weight per unit area of the leaflets of such plants, from the youngest to the oldest. Increasing severity of potassium starvation was also associated with a progressive increase in the level of the dry weight per unit area. These data indicate that the translocation of carbohydrates is impaired in potassium-deficient plants. The juice of affected areas of blotchy fruit shows low amylolytic activity and the cell walls of the phloem may be extensively thickened; it is suggested, therefore, that the sugars are being condensed to cellulose in the blotchy fruits instead of participating in the normal ripening processes. The author concludes that blotchy ripening is symptomatic of deranged carbohydrate metabolism and may well be accompanied by derangement of the water relations.

Bouhelier (R.). **Quelques maladies dans les maraîchages.** [Some diseases in market gardens.]—*Fruits & Primeurs*, viii, 86, pp. 137–139; 87, pp. 173–174, 1938.

After stating that losses from fungal and insect diseases in market-gardens in Morocco may amount to 50 per cent. of the crop, the author gives a full account in popular terms of the symptoms of tomato early blight (*Alternaria solani*) [*R.A.M.*, xvi, p. 369; xvii, p. 96] and recommends the following measures of control. After harvest, all tomato plants and potato haulms must be burnt. At transplanting, every young plant showing the least trace of infection must be destroyed, and every bed showing too high an incidence of the disease must be eliminated. Transplants killed off by infection must be burnt. Affected fruits must be buried deeply, and the pit sprinkled with a strong disinfectant and covered with a thin layer of lime or a thick layer of earth. No tomato debris must be thrown on the dung-heap. Seed-beds must be disinfected with formalin and sowing should be carried out about 10 days later. The seedlings must be sprayed with cupric mixtures, and at transplanting the young plants should be dipped in a neutral cupric mixture, preferably Bordeaux mixture. Spray (or dust) applications must be made as soon as vegetation starts, and at frequent intervals.

Inoue (Y.). **Studies on the leaf-mould of Tomatoes.**—*Forsch. PflKr., Kyoto*, iii, pp. 310–335, 1937. [Japanese, with English summary. Received August, 1938.]

The writer's studies on tomato leaf mould in Japan showed that the causal organism, *Cladosporium fulvum*, penetrates the under side of the leaves through the stomata [*R.A.M.*, xvii, p. 634]; within a fortnight a grey or yellowish-brown mould develops over the invaded area, and in less than a month the infected leaf shrivels and drops. *C. fulvum* grew well on a synthetic agar medium containing peptone, potato decoction plus 2 per cent. saccharose, and soy-onion decoction or agar.

The most profuse development occurred at 20° to 24° C. [ibid., ix, pp. 70, 566], the maximum temperature for growth being ordinarily about 32° but decreasing in very acid media. The conidia germinate abundantly in 8 to 10 hours at the optimum temperature under very moist conditions (relative atmospheric humidity exceeding 92 per cent.). The optimum temperature for infection of the host appears almost to coincide with that for conidial germination. The course of the disease is influenced by the temperatures prevailing during the incubation period, a mean of 23° having been found most propitious under the conditions of the author's tests.

BROWN (NELLIE A.). **The tumor disease of Oak and Hickory trees.**—*Phytopathology*, xxviii, 6, pp. 401–411, 4 figs., 1938.

From galls on the trunk and branches of oak and hickory trees varying in size from less than $\frac{1}{2}$ to over 12 in. in diameter and resembling crown gall in external appearance the author repeatedly failed to obtain *Bacterium tumefaciens* to which the galls have generally been attributed. No fungal fructifications have been observed on living galls, even when placed in a moist chamber, but isolations from overwintered galls yielded pycnidia of a *Phomopsis* [*R.A.M.*, xvi, p. 41] with *a* and *b* spores. Other cultures produced *Phoma*-like spores at first, and after chilling *Phomopsis* spores of both *a* and *b* types. Inoculations with the *Phomopsis* isolated from both oak and hickory produced galls on oak, hickory, *Viburnum opulus*, privet (*Ligustrum vulgare*), and *Jasminum nudiflorum*, and the fungus was successfully reisolated in each case; the strain from oak also produced galls on the cultivated blueberry (*Vaccinium corymbosum*). The parasite appears to be a weak one, entering the young tissues only through a wound and under moist conditions. No perfect stage of the fungus has as yet been obtained. The slow growth of the galls and spread of infection facilitate control of the disease by sanitation methods. Galls on maple (*Acer*) and elm trees have also yielded a fungus with *Phoma*-like spores, but so far inoculations have only resulted in some swellings and not galls. Isolations from the elm developed *Phomopsis* spores after chilling.

BEDWELL (J. L.) & FOWLER (M. E.). **Fungi found on Chestnut and Chinquapin in Oregon, Washington, and British Columbia.**—*Plant Dis. Reptr*, xxii, 11, pp. 208–210, 1938.

A list is given of 18 fungi so far found on species of *Castanea* and *Castanopsis* in Oregon, Washington, and British Columbia.

GOIDÀNICH (G.). **Nuove osservazioni sul 'disseccamento dei germogli' dei Pioppi.** [New observations on the 'withering of the shoots' of Poplars.]—Reprinted from *R.C. Accad. Lincei*, xxvii, 11, 3 pp., 1938.

After recapitulating the cultural differences between the Sphaeropsid G2191 and *Pollaccia radiosa* [*Venturia tremulae*: *R.A.M.*, xvii, p. 137] isolated from poplars in Italy affected with so-called 'spring defoliation', the author states that in 1936 shoot infection was almost entirely due to the former and only slightly to the latter, which was causing

severe leaf infection, but in 1937 and 1938 the Sphaeropsid was rare or only sporadic, while shoot infection by *P. radiosa*, hitherto regarded as a leaf parasite, was abundant.

It is now apparent that, whether the disease is due to the Sphaeropsid or to *P. radiosa*, the first severe attacks generally occur, in years when the spring is wet, from the middle of April to the beginning of May, after the first hot days. This happened in 1936 and 1937. In 1938, however, when the spring was exceptionally dry and cold, it was not until the last ten days of May, after the first spring rains, that a few infected shoots and leaves were found in Piedmont, Emilia, and Lombardy. The disease is not confined to the spring, but continues to develop, though to a less extent, throughout the summer, and into the autumn, the new foliage that appears after the first attacks repeatedly becoming infected.

Almost all the poplar plantations in the parts of the Po Valley nearest to the river are affected, and shoot infections were also found in Latium in 1937. Noteworthy progress is stated to have been made in the selection of resistant varieties.

Servazzi (O.). **Contributi alla patologia dei Pioppi. V. Segnalazione di tumori su Pioppo bianco.** [Contributions to the pathology of Poplars. V. Report of galls on White Poplar.]—*Boll. Lab. sper. R. Oss. Fitopat. Torino*, xv, 1–2, pp. 30–33, 1 pl., 1 fig., 1938. [French, German, and English summaries.]

During the spring of 1938, a row of about a dozen 10- to 12-year-old white poplars [*Populus alba*] in a road in Villafranca, Turin, showed the presence of galls up to 15 cm. in diameter, mostly on the branches, though a few were present near the tops of the trunks. Similar galls up to 5 cm. in diameter were also found on a few willows in the vicinity. The young galls were yellowish-red to red, round, scabrous, and somewhat cracked, and the old galls were more irregular, mammillate, hard, woody, greyish-brown or blackish, and much cracked on the surface. From these galls the author isolated several bacteria, including *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, ix, p. 631], and an organism probably identical with *Bacillus populi* [ibid., x, p. 417], to which Brizi in 1907 attributed similar galls on *P. alba*, *P. tremula*, and *P. nigra*. Repeated needle-prick inoculations with this bacillus invariably gave negative results, from which the author concludes (in common with E. F. Smith) that *B. populi* is only saprophytic; he considers that Brizi's positive inoculations were probably made with cultures of *B. populi* contaminated with *Bact. tumefaciens*; in his opinion the tumours observed by him in Villafranca were produced only by *Bact. tumefaciens*.

Went (Johanna C.). **Compilation of the investigations on the susceptibility of different Elms to Ceratostomella ulmi Buisman in the Netherlands.**—*Phytopath. Z.*, xi, 2, pp. 181–201, 2 figs., 1938.

This is a summarized account of the results obtained up to the end of 1937 from investigations started by Dr. Buisman in 1931, and since continued by the author, on the susceptibility of different varieties of elms to *Ceratostomella ulmi* [*R.A.M.*, xvii, pp. 213, 636]. Progress reports on the work have been regularly published in Dutch by the Committee

appointed for the study and control of the elm disease and have already been noticed in this *Review*.

REUTHER (W.) & DICKEY (R. D.). **A preliminary report on frenching of Tung trees.**—*Bull. Fla agric. Exp. Sta.* 318, 21 pp., 9 figs., 1937. [Received September, 1938.]

Bronzing of tung trees (*Aleurites fordii*) [*R.A.M.*, xiv, p. 481] has been successfully controlled during the past four years by the extensive use of zinc sulphate in Florida, but another disorder, possibly previously masked by bronzing and designated frenching, has been found to be rather widely distributed and severely affected a few areas in some of the commercial tung plantings in 1937, 5 to 10 per cent. of the trees in a total of 17 plantings surveyed (8,000 acres) showing symptoms in some degree. It is described as a partial chlorosis of the foliage, with necrotic spots in the chlorotic areas, and involving premature abscission of some of the leaves. When severely frenched shoots on two trees were tagged and dipped in a 1 per cent. solution of manganese sulphate to which 1 per cent. hydrated lime and about 1 per cent. calcium caseinate spreader were added, the leaves regained their normal colour within 30 days, and in similar experiments repeated in various localities frenched leaves responded to manganese treatment in some cases after three but more usually after four to six weeks. Immature leaves on rapidly growing shoots, which usually showed more severe symptoms than the hardened mature leaves, also responded more rapidly to manganese treatment, and the evidence indicates that frenching, and hence manganese utilization, is associated with rapid vegetative growth. Field trials with soil applications of manganese thus far conducted are yet too limited to allow of any definite recommendations for large-scale control, but it is suggested that growers having trees affected should make small experimental applications. An analysis of soil reaction showed that frenching was not confined to overlimed or highly calcareous soils but was negatively correlated with the exchangeable manganese content of the soil. Four out of five surface soil samples from areas free of frenching contained an average of about 3 lb. per acre of replaceable manganese whereas the samples from 10 areas affected with frenching contained an average of about 1 lb. per acre. In an additional experiment with a few trees of *A. montana* affected with frenching, a diseased tree made a striking recovery after two soil treatments with manganese sulphate ($\frac{1}{2}$ lb. and 5 lb.).

ROHMEDER (E.). **Versuch mit einem Schutzmittel gegen Buchenstocken.** [An experiment with a prophylactic against Beech rotting.]—*Forstwiss. Zbl.*, lx, 11, pp. 329–332, 1938.

Particulars are given of an experiment in the control of fungal rotting of felled beech logs at Grafrath, near Munich, by the application to the cut surfaces, branch insertion sites, decorticated ring (for measuring), and any cracks detected in the bark, of a proprietary preparation known as 'Marktredwitz' (Chem. Fabr. Marktredwitz). Five of the 15 trial logs (1 to 5) were treated immediately after felling on 6th May, 1936; on the same date another 5 (6 to 10) cut down ten weeks earlier (20th February) were similarly painted, while the remaining 5 (11 to

15), also felled on 20th February, were left untreated. All the logs were left lying in the open until April, 1937, when they were cut into planks and boards at the local sawmill. Nos. 1 to 5 showed very slight fungal infiltration to a depth of 10 to 30 cm. from the cut surface, whereas 6 to 10 and 11 to 15 were both penetrated by micro-organisms for distances of up to 2 m. Depreciation in the wood given immediate treatment was inconsiderable, whereas the economic value of the logs in the delayed applications and control series was greatly reduced; the proportions of the three lots fit for structural purposes were 92, 65, and 61 per cent., respectively.

Hemmi (T.) & Akai (S.). **On Cyclomyces fuscus Kz. causing wood-rot of Shiia sieboldi Makino.**—*Forsch. PflKr., Kyoto*, iii, pp. 342–346, 1 pl., 1 fig., 1937. [Japanese, with English summary. Received August, 1938.]

Cyclomyces fuscus Kunze is stated to be prevalent throughout the south of Japan, causing a white pocket rot chiefly of the peripheral portion of the wood of *Shiia sieboldi* [syn. *Pasania sieboldi* (Fagaceae)]. The irregularly shaped and sized, predominantly elongated pockets are scattered in profusion through the affected wood. In the completely decayed areas the sound tissue between the pockets is so thin as to present a reticulate appearance. The hyaline, shortly ellipsoid or ovoid to pip-shaped spores, pointed at one end and sometimes slightly curved, measure 2·8 to 4 by 1·4 to 2 μ.

Hemmi (T.) & Akai (S.). **Studies on the brown heart-rot of Shiia sieboldi Makino.**—*Forsch. PflKr., Kyoto*, iii, pp. 58–70, 3 pl., 3 figs., 1937. [Japanese, with English summary. Received August, 1938.]

Following on a typhoon of unprecedented severity in the Kinki district of Japan in September, 1934, many of the injured trees were found to be suffering from heart rot, which in the case of *Shiia sieboldi* and related species assumed the form of a deep brown, crumbly decay. The affected wood broke up into cubes owing to the formation of shrinkage cracks, which were frequently filled with thin but leathery mycelial mats. *Polyporus sulphureus* [*R.A.M.*, xvi, p. 716] was isolated from the diseased tissues, and in the following season two sporophores of the fungus were collected on the fallen trunks. On apricot, potato, and soy-onion decoction agars the minimum, optimum, and maximum temperatures for the growth of the organism were found to be 9° to 12°, 28° to 32°, and just above 36° C. Hyaline spherical to ovoid secondary spores, 6·6 to 13·3 by 6·6 to 10 μ, were formed singly in pure culture at the branch tips of the yellowish-brown, cottony or powdery mycelium.

Hunt (G. M.). **Preservative treatment of window sash and other millwork.**—10 pp., For. Prod. Lab., U.S. Dep. Agric., 1938. [Mimeographed.]

In this semi-popular bulletin, the author points out that heartwood is more resistant to decay than sapwood [*R.A.M.*, xvii, p. 151], which alone is susceptible to sap stain, and states that the use of durable woods (especially the heartwood) for the manufacture of window sashes and

frames provides a simple, if not the most practical or economical, method of avoiding decay. Paints and varnishes are not effective, and where the use of resistant wood is not possible, it is recommended that the finished wood parts be immersed directly before assembly for at least 3 minutes in any of the modern high-quality preservatives (generally consisting of an organic toxic chemical carried in a volatile solvent), longer and more thorough impregnation being, however, advisable for wood parts to be used in conditions favouring rapid decay and blue stain.

SCHMITZ (H.) & KAUFERT (F.). **Studies in wood decay. VIII. The effect of the addition of dextrose and dextrose and asparagine on the rate of decay of Norway Pine sapwood by Lenzites trabea and Lentinus lepideus.**—*Amer. J. Bot.*, xxv, 6, pp. 443–448, 2 figs., 1938.

Using the same methods as in earlier investigations [*R.A.M.*, xvi, p. 358] the authors conducted a series of experiments in which dextrose alone or with asparagin was added to air-dry Norway pine [*Pinus resinosa*] sapwood sawdust, inoculated with either *Lenzites trabea* or *Lentinus lepideus* [ibid., xvii, p. 4]. The data obtained showed that the addition of small or considerable quantities of dextrose significantly increased the average loss in total weight of sawdust and dextrose, caused by *Lenzites trabea* (from 36·5 per cent. in the control to 46·6 per cent. both with 0·3 gm. and with 4·8 gm. dextrose added), and decreased the average loss in total weight caused by *Lentinus lepideus* (from 20·3 per cent. in the control to 18·7 and 14·2 per cent. with 0·3 and 4·8 gm. dextrose added, respectively). When both dextrose and asparagin were added the rate of decay caused by *L. lepideus* generally decreased still further (7·3 per cent. loss in weight for the addition of 0·3 gm. dextrose and 0·9 gm. asparagin), while the rate of decay caused by *Lenzites trabea* was increased by the addition of small amounts of dextrose and asparagin, but was decreased by addition of larger amounts of the substances, especially of asparagin (the addition of 0·3 gm. dextrose plus 0·45 gm. asparagin and of 4·8 dextrose plus 0·90 gm. asparagin resulting in 47·3 per cent. and 27·5 per cent. loss in total weight, respectively, compared with 36·5 per cent. in the control). In further experiments, in which colonies of the two fungi were grown on agar prepared from Norway pine sapwood sawdust, it was seen that the addition of dextrose increased the radial growth of *Lenzites trabea*, except for the highest concentrations; the addition of both dextrose and asparagin did not greatly influence the radial growth of the fungus, but made the mycelial mat more copious and fluffy. In the case of *Lentinus lepideus* the radial growth was little influenced by the addition of dextrose in concentrations up to 2·64 per cent., but was retarded considerably by the addition of 5·28 per cent. of dextrose or of asparagin in 0·5 or 1·0 per cent. concentrations; the addition of asparagin also considerably changed the character of the mycelial mat. It appears from these data that in the presence of dextrose and asparagin *Lenzites trabea* manifests no selective feeding and destroys wood at the same or somewhat increased rates, while *Lentinus lepideus* utilizes the more available nutrients producing large quantities of mycelium, but does not attack wood as rapidly as in the absence of these nutrient substances.

Hunt (G. M.) & Wirka (R. M.). **Tire-tube method of fence post treatment.**—10 pp., 3 pl., For. Prod. Lab., U.S. Dep. Agric., 1938. [Mimeographed.]

This is a very simple, economical, and reliable method of preserving freshly cut fence posts which have not been split. The bark is peeled for a distance of 4 to 6 in. from the larger end, and a piece of old inner tube 2 to $2\frac{1}{2}$ ft. long is slipped over the peeled surface and bound in place. The post is laid on a rack so that the large end is about $1\frac{1}{2}$ ft. or more higher than the small one, and the loose end of the rubber tube is fixed to a frame so that the requisite quantity of a 10 per cent. solution of zinc chloride can be poured into the tube. About 1 lb. zinc chloride should be absorbed per cubic foot of wood, the solution as it flows into the post forcing out the sap at the small end. With aspen posts 7 ft. long, the treatment generally takes 8 to 24 hours; it is expedited by warm weather. Outdoor treatment in freezing weather is not generally practicable, and posts treated indoors during frosts should first be allowed to thaw thoroughly. It is considered that posts treated by this method may be expected to last from 10 to 15 years.

[An account of this method appears in *Bett. Fruit*, xxxiii, 1, p. 7, 1938, and in *Agric. News Letter*, vi, 8 & 9, pp. 101–11, 3 figs., 1938.]

Schmidt (E. W.). **Ein neuer Weg zur Bekämpfung der Cercospora-Blattfleckenkrankheit der Zuckerrüben.** [A new way of controlling the *Cercospora* leaf spot disease of the Sugar Beet.]—*Angew. Bot.*, xx, 3, pp. 241–245, 1938.

The author's field observations in 1937, a year distinguished by abnormal climatic conditions and a resulting prevalence of the leaf spot disease of sugar beets (*Cercospora beticola*) [*R.A.M.*, xvii, p. 428], showed that in many cases rows of beets severely attacked by the disease grew next to entirely healthy rows. It was found that in the first case seed-clusters from the 1936 harvest had been used and in the second case those from the harvest of 1935. When the seed-clusters from 1936 and 1937 were examined in 1937, after careful and repeated washing, soaking in distilled water, followed by three days' incubation on damp filter paper at a temperature of 28° C., no spores of *C. beticola* were found, and therefore no viable mycelium is thought to have been present in the 1936 clusters (which were then $1\frac{1}{4}$ years old), while spores were developed in about 30 per cent. of the 1937 clusters. It is concluded, therefore, that the mycelium remains viable in the clusters for about one year and that consequently either disinfection of the clusters or the use of one-year-old clusters should constitute a good measure of control.

Service and regulatory announcements. January–March, 1938.—*S.R.A.*, *B.E.P.Q.* 134, pp. 4–36, 1938.

Summaries are given of the plant quarantine import restrictions in force in St. Christopher (St. Kitts) and Nevis, Gold Coast, Papua (Australian Territory), Iraq, Italy, Japan, and the Union of South Africa. Supplementary notices of amended legislation are also given for Egypt, France, Bulgaria, the Argentine, Ceylon, Sweden, Morocco (French Zone), Central America (Salvador and British Honduras), Yugoslavia, Persia [Iran], and French Colonies (Oceania).

IMPERIAL MYCOLOGICAL INSTITUTE

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KATSURA (K.). **Studies on Trametes dickinsii Berk. causing the dry-rot of sleepers.**—*Forsch. PflKr., Kyoto*, iii, pp. 268–288, 2 pl., 1937. [Japanese, with English summary. Received August, 1938].

Trametes dickinsii is the agent of a powdery, brown rot of railway sleepers made of chestnut, oak, *Pasania*, and beech wood in Japan [*R.A.M.*, xiii, p. 135]. The sporophores of the fungus usually develop on the sides and cut ends of the sleepers, and their common habit of uniting produces deformed structures. The best media of the 18 tested for the growth of the organism were soy-bean with onion and apricot decoctions, on which the loose aerial mycelium gradually turned from white to light brownish. Development occurred throughout a temperature range from 6° to 40° C., with an optimum at about 30°. The mycelium from potato decoction agar was destroyed by ten minutes' heating in a water bath at 60°. Microchemical and cultural tests showed that the fungus belongs to the cellulose-dissolving group [cf. ibid., viii, p. 281; xvii, pp. 361, 495 *et passim*].

The design of timber floors to prevent dry rot. Notes from the Information Bureau of the Building Research Station.—*J. R. Inst. Brit. Archit., Suppl.*, 4th Ser., 1, 7 pp., 1 diag., 1938.

A summary, prepared in co-operation with the Forest Products Research Laboratory, is given of the available knowledge on the design and construction of three types of wooden floors—solid, partially suspended, and totally suspended—by methods calculated to prevent infection by *Merulius lacrymans* and *Coniophora cerebella* [*C. puteana*: *R.A.M.*, xvi, p. 508].

WATERMAN (R. E.), LEUTRITZ (J.), & HILL (C. M.). **Chemical studies of wood preservation. The wood-block method of toxicity assay.**—*Industr. Engng Chem.*, Analyt. Ed., x, 6, pp. 306–314, 9 figs., 1938.

This is a full account of the newly developed method employed at the Bell Telephone Laboratories, New York, for testing wood preservatives. It is thought to incorporate the best features of the Petri dish method as developed at the Forest Products Laboratory [Wisconsin] and the Kolle flask method of Europe [*R.A.M.*, xiv, p. 411 *et passim*]; the former is objected to because of the artificial character of the dispersion of the preservative in agar, and the latter because of its liability to inhibit decay by excessive supply of water to the test block.

The test is carried out on wood blocks 2 by 2 by 2 cm. bored with a hole 0·2 cm. in diameter and numbered. All blocks are brought to a constant relative humidity of 76 per cent. at 30° C. obtained by fitting a bacteriological incubator with slow moving fans and dishes of saturated sodium chloride solution, the average time taken to reach equilibrium weights being 3 to 4 days. The volume of the blocks is calculated from the weight of mercury displaced. The blocks are then impregnated under reduced pressure, and the amount of preservative retained determined by weighing. The apparatus used for the test consists of two bottles, the smaller one, placed inside the larger, supporting a thin slab of untreated sap wood (4·5 by 2·5 by 0·3 cm.) bored with two holes 0·5 and 0·2 cm. diameter and about 1 cm. apart. The impregnated block is anchored to the thin slab by half-lengths of standard wooden applicators (16·5 cm. long) passed through the holes bored in the slab and block. Water is added to the outer bottle. Sterilization is then carried out in the autoclave, and when the apparatus has cooled sufficiently sterile water is siphoned into the inner bottle. The additional moisture requisite to secure maximum decay of the wood is supplied by conduction through the applicators. Inoculum from an agar culture is then added to the slab of wood at the end opposite the test block and the bottles incubated at 26° to 28°, usually for a period of 24 weeks.

The fungi commonly used in the tests are *Poria incrassata* [ibid., xvii, p. 635], *Coniophora cerebella* [*C. puteana*], *Polyporus vaporarius* [*Poria vaporaria*], *Fomes roseus*, and U. 10 (a virulent organism isolated from a pine pole), whilst *Trametes serialis* [ibid., xvii, p. 4], *Lenzites sepiaria*, *Polystictus versicolor* [ibid., xvii, p. 496], *Polyporus sulphureus* [ibid., xvii, p. 782], and *Fomes pinicola* [ibid., xvii, p. 567] are occasionally used in the supplementary trials. *Lentinus lepideus* and *Lenzites trabea* are chiefly used for testing organic preservatives, as these fungi have been found to be too sensitive to inorganic salts.

The results are recorded by noting the growth rating in comparison with the inoculated untreated control, the growth being designated by a pair of numbers, the first indicating the extent of the block covered and the second intensity and vigour; by computing the percentage loss in weight from the equilibrium weights before and after exposure to the fungus; and by determining the strength of exposed blocks in comparison with uninoculated impregnated controls by dissection and breaking, a rating of 10 denoting no detectable loss in strength and 0 complete disintegration. In an experiment to compare the writers' technique with the Kolle flask method, the agreement was in general very satisfactory, but the weight losses of *Pinus sylvestris* blocks attacked by *L. sepiaria* under the American test conditions are about double those of any other investigator. Specimen results are given of a number of assays carried out by the method. Evidence is stated to be accumulating from correlated field exposure tests that indicates a high degree of specificity for the method.

Giddings (N. J.). **Studies of selected strains of curly top virus.**—*J. agric. Res.*, lvi, 12, pp. 883–894, 1 pl., 2 figs., 1938.

In these studies four strains of the beet curly top virus [*R.A.M.*, xvii, p. 718] were differentiated on the basis of the reaction to them of the

new highly resistant beet 1167, a selected susceptible strain 2769–24, and a susceptible European type [unspecified]. The plants were inoculated while very young by placing a viruliferous leafhopper (*Eutettix tenellus*) on each plant for a week, and the resulting symptoms graded from 0 (none) to 5 (extreme curling and dwarfing). The data obtained showed that strains 1, 2, 3, and 4 induced severe, mild, extremely severe, and mild symptoms in the susceptible beets, respectively, though all four strains showed an almost equally high ability to infect, whereas on the resistant variety strains 1 and 2 produced a high percentage of infection with mild to moderately severe and very mild symptoms, respectively, and strains 3 and 4 rare and little infection, respectively, with very mild symptoms. In tests on other hosts, strains 1 and 3 gave fairly high percentages of infection on tomato and tobacco whereas strains 2 and 4 gave no infection. Differentiation between strains 1 and 3 could not be made on these hosts or on beans (*Phaseolus vulgaris*), plantain (*Plantago erecta*), or *Lepidium nitidum*, though on the last-named strains 1 and 3 showed a significant difference in the percentage of plants infected.

HARTER (L. L.). **A root rot of Peas caused by Fusarium coeruleum.**—*Phytopathology*, xxviii, 6, pp. 432–438, 1 fig., 1938.

The writer isolated with considerable frequency from rotted roots of pea plants a species of *Fusarium* referred in spite of somewhat large spore sizes to *F. coeruleum* [*R.A.M.*, xvii, p. 374], a virulent and widely distributed organism which has not so far been described as causing root rot of peas. The fungus destroys many of the seeds before they germinate, and many seedlings are decayed before the plants emerge from the soil or soon after, whilst the plants which escape early decay, especially those that attain a height of 6 to 8 in. before they are attacked, are rarely killed. In resistance tests none of the 24 varieties of peas proved to be resistant, while the pigeon pea (*Cajanus indicus*) was almost completely immune. The range of optimum temperatures for the growth of the organism corresponded with those for the growth of the host.

NATTRASS (R. M.). **Notes on fungus diseases.**—*Cyprus agric. J.*, xxxiii, 2, pp. 55–58, 4 figs., 1938.

In Cyprus, beans [*Vicia faba*] do not generally suffer much reduction in yield as a result of infection by chocolate spot (*Botrytis fabae*) [*R.A.M.*, xvii, p. 15] but in 1938 the disease caused almost complete defoliation and loss of crop on beans approaching maturity.

All species and varieties of beet in Cyprus are susceptible to *Cercospora* [*beticola*], the leaf spots caused by which seldom exceed $\frac{1}{8}$ in. in diameter. During 1938, the leaves of leaf beet [*Beta vulgaris* var. *cicla*] were attacked by a more serious infection due to *Phyllosticta* (*Phoma*) *betae* [ibid., xiv, p. 548], the lesions caused by which reached $1\frac{1}{2}$ in. in diameter, generally had concentric markings and a pale centre, and became perforated; the lesions coalesce, and owing to their large size only a few suffice to make the crop unmarketable. The disease, however, is not widely distributed, and attempts should be made to

eradicate it by ploughing in or feeding off the affected plants; spraying with Bordeaux mixture may be carried out in the very early stages of the disease. Only healthy plants must be used for seed.

HARTER (L. L.). **Mosaic of Lima Beans (Phaseolus lunatus macrocarpus).**—*J. agric. Res.*, lvi, 12, pp. 895–906, 3 pl., 1938.

The results of the author's continued studies on the mosaic disease of Lima bean (*Phaseolus lunatus macrocarpus*) [*R.A.M.*, xv, p. 547] indicate that the causal virus is very similar to the cucumber and celery viruses and is considered to be a strain of the former. The points in which it differs from the cucumber and celery viruses are as follows: it is able to infect *Vicia faba*, while they are not; it produces a primary lesion on the inoculated leaves of tobacco not found on leaves inoculated with either of the other two viruses; it becomes inactivated at 70° C. after 10 minutes, while the celery virus needs 75°; and it withstands ageing *in vitro* longer than the cucumber virus. In resistance tests the following varieties were resistant to Lima bean mosaic: Burpee Best, Burpee Improved, Carpenteria, Challenger, Detroit, Mammoth, Dreer Bush, Dwarf Large White, Early Jersey, Fordhook, King of the Garden, Large White, Leviathan, McCrea, New Wonder, and Seibert; the susceptible varieties were Florida Butter, Florida Speckled, Henderson Bush, Hopi, Jackson Wonder, Sieva, Willow Leaf, and Woods Prolific.

PITTMAN (H. A. J.). **Bacterial blight of Beans.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xv, 2, pp. 172–177, 2 figs., 1938.

Since the first occurrence of bacterial blight (*Bacterium medicaginis* var. *phaseolicola*) [*R.A.M.*, xvii, p. 170] of beans (*Phaseolus vulgaris*) in Western Australia in 1930–1 [ibid., xi, p. 618] devastating losses have occurred in several localities in the State in extra early crops of Canadian Wonder beans. Emphasis is laid on the fact that control consists either in planting seed from disease-free crops and using new land or land that has not grown an affected crop for at least three years, or in planting resistant or immune varieties. Growers who know that their land and crops are clean are strongly advised to raise their own seed. Clean seed may be obtained from a diseased line by growing a crop during hot, dry weather, keeping down artificial watering to an irreducible minimum, and promptly removing and burning all affected plants. The seed should be sown much more widely spaced than in commercial crops. After handling diseased plants, healthy ones should not be touched until the hands have been carefully washed in carbolic soap or rinsed in methylated spirits, and no work should be done among the plants while moisture is present on them. Resistant varieties [ibid., xvi, pp. 150, 441] include Kentucky Wonder, Epicure, Pale Dun, Feltham's Prolific, and the Startler variety of butter bean. The white-seeded runner bean, apparently nameless, commonly grown in parts of Western Australia has saved the situation in the State, as it appears to be absolutely immune. It does not mature so early as Canadian Wonder, but in every other respect is a satisfactory substitute. Growers who cannot obtain entirely clean seed and plant it in clean soil are advised to give up growing the Canadian Wonder variety.

Hemmi (T.) & Niwa (S.). **On gray-mold neck rot of stored Onions.**—*Forsch. PflKr., Kyoto*, iii, pp. 234–249, 2 pl., 1937. [Japanese, with English summary. Received August, 1938.]

Grey mould neck rot is stated to be prevalent on stored onion bulbs in the markets and shops of Kyoto and Osaka, Japan, from December to May. Detailed investigations of the symptomatology of the disease and morphology of the associated fungus have led to the identification of the latter as *Botrytis allii* [*R.A.M.*, xiv, pp. 195, 710], though *B. byssoidea* [ibid., ix, pp. 82, 472] and *B. squamosa* [ibid., vii, p. 495], the agents, respectively, of mycelial and sclerotial neck rots, were very occasionally observed. Comparative cultural studies on 13 strains of *B. allii* on agar media revealed no differences of sufficient significance to justify the establishment of physiologic races of the fungus. Infection takes place primarily through the neck tissue, but the scale bases or wounds may also serve as channels of entry. On the outer infected scales the fungus produces a dense grey layer consisting of relatively short conidiophores and innumerable conidia. Sclerotia were commonly formed in or on the older decayed tissue, but did not invariably develop in culture. Although infection was facilitated by wounding the bulbs before introducing the conidia, *B. allii* was experimentally shown to be capable of penetrating the unbroken cuticle of succulent scales. The optimum temperature for the development of neck rot was found to range from 13° to 25° C.

Fikry (A.). **Watermelon anthracnose.**—*Bull. Minist. Agric. Egypt* 190, 21 pp., 10 pl., 1938.

During recent years anthracnose (*Colletotrichum lagenarium*) *R.A.M.*, xvii, pp. 429, 574] has been a limiting factor in watermelon production every season in Egypt, and in some localities has destroyed the entire crop. The disease appears on the foliage 8 to 10 weeks after sowing and is favoured by high temperatures, spreading slowly in April and May but very rapidly in June and July. The data obtained in a large-scale trial of varieties for resistance showed that susceptibility varied in the very early stage of infection, but later on all the plants became severely affected, a large number of plants in most of the varieties being killed off. Fruit infection (10 to 30 per cent.) occurred mainly on varieties bearing oblong fruits.

When the Chilian Black Seeded variety was sown at weekly intervals from 6th March to 24th April, $3\frac{1}{2}$ months after the first sowing date the consecutive plantings had, respectively, 50, 46, 37, 35, 24, 25, 17, and 6 per cent. infection, but two weeks later all the plantings showed 100 per cent. infection, the severity of which, however, varied with sowing date, infection being slight on the plants sown 7 to 9 weeks, moderate on those sown 11 to 13 weeks, and severe on those sown 12 to 14 weeks. Both as regards temperature and agricultural considerations, March appears to be preferable to April for sowing watermelons.

Of eight fungicides applied to Kleckley Sweet watermelons 7, 9, and 12 weeks after sowing only ordinary dusting sulphur gave satisfactory control, reducing infection to 2 per cent., as compared with 94 to 100 per cent. infection in the other treatments and the control. This result

was confirmed by a further, large-scale test with the Black Seeded variety.

KOVACHEVSKY [KOVAČEVSKI] (I. C.). **Die Braunfleckenkrankheit der Paprikapflanze Cladosporium capsici (March. und Stey.) n. comb.** [The brown spot disease of the Chilli plant, *Cladosporium capsici* (March. & Stey.) n. comb.]—*Z. PflKrankh.*, xlviii, 7, pp. 321–336, 10 figs., 1938.

A brown spotting of the under sides of chilli leaves, starting from the base of the plant and progressing upwards, was first observed by the writer in Bulgaria in 1935 (though believed to have been present for seven or eight years), and was again noticed in another locality in 1936. The circular to oval, velvety lesions, which affected only the foliage, numbered 50 or more on a single leaf and attained a diameter of 3 to 8 mm., occasionally up to 1 or 1·5 cm., frequently coalescing to cover the entire surface. No further appreciable change occurs for some time, but eventually the diseased tissues shrivel and the leaves curl up like a spool before dropping. The fruits ripen prematurely and rapidly become first soft and then mummified, in which state they remain attached to the branches. The only types of chilli showing a fair degree of resistance to the brown spot were those with short, squat fruits, used exclusively for preserving, and a kind with short, pointed, very pungent fruits. The disease is prevalent in the latter part of July, when the dense stands promote the warm, humid atmosphere necessary for its development. The super-luxuriant growth of the plants, which largely contributes to the establishment of infection, is locally ascribed to the regular use of synthetic nitrogenous fertilizers on a naturally rich soil. The economic importance of the brown spot, though not of the first order, is by no means negligible, especially in relation to the preserving and drying industry.

The fungus is characterized by an intercellular mycelium, forming in the stomatal chambers dense, obtusely conical stromata which give rise to sparsely septate, dark brown, straight or slightly curved conidiophores, up to 65 μ high, arranged in fascicles of 50 to 60 with pointed tips, sometimes furnished with denticulate or geniculate lateral swellings; the light to olive-brown conidia, produced singly or in chains, are rod-shaped with tapering, denticulate, or geniculate ends, arcuate, ellipsoid, oval, piriform, or reniform, usually non- or uniseptate, occasionally with up to 5 septa, 10 to 85·5 by 3·2 to 5·2 μ (average 26·5 by 4·2 μ). In culture the fungus grew very slowly, and attained a diameter of scarcely 2 cm. on oatmeal agar after two months. On agar media the colony is coal-black and flat to convex, covered with a brownish-black, loose mycelium, sometimes dense and white in the centre. The submerged mycelium consists of densely woven, brownish-black, thick-walled hyphae, forming a stromatic tissue. The aerial mycelium gave rise to a limited number of conidia identical with those produced on the host. Dark brown, flask-shaped, globular, or conical rudimentary perithecial bodies, up to 85 μ in height and 60 μ in width, were formed in pure culture (e.g., oatmeal agar and sterilized chilli stems and fruits, and tomato stems) and on overwintered chilli leaves, but failed to mature. Inoculation experiments on chilli plants in the greenhouse

with spore suspensions of the fungus from the leaves gave positive results.

From a study of the literature on chilli diseases comparable to the foregoing, it appears that those described under the names of *Cercospora capsici* Marchal & Steyaert [*R.A.M.*, ix, p. 135], *C. capsici* Unamuno [ibid., xi, p. 605], and *Cladosporium* sp. Bensaude [ibid., vi, p. 81] are identical with the disorder under observation, whereas *Cercospora capsici* Heald & Wolf (*Mycologia*, iii, p. 5, 1911) is quite distinct. The Bulgarian chilli fungus presents many analogies both with *Cercospora* and *Cladosporium*, and indeed constitutes one of the transitional forms between the two genera placed by Solheim in *Ragnhildiana* [*R.A.M.*, xi, p. 129]. In consideration of the extreme similarity between the chilli leaf spot and tomato leaf mould caused by *Cladosporium fulvum*, and for other reasons the writer proposes the name of *C. capsici* (March. & Stey.) n. comb. for the agent of the former disease.

Like *C. fulvum*, *C. capsici* is liable to parasitization by a species of *Botrytis* [ibid., xii, p. 713] with trebly branched conidiophores, the uppermost branches bearing very short sterigmata on which are formed globular conidia, 3 to 5 μ in diameter.

Opsomer (J. E.). **De invloed van de mozaïekziekte op de opbrengst van de Cassave.** [The influence of mosaic on the yield of Cassava.]—*Bull. agric. Congo belge*, xxix, 2, pp. 317–322, 1938. [French summary.]

Experiments carried out in the Belgian Congo in 1936–7 showed that the yield of mosaic cassava cuttings [*R.A.M.*, xv, p. 701] was 44·4 per cent. less than that of healthy cuttings. The loss of crop sustained when plantings are made from cuttings that have not been selected may reach 10 per cent. or more, this figure indicating the importance of using only healthy cuttings.

Broekhuizen (S.). **Ziekten en plagen van de Champignonkultuur.** [Diseases and pests of cultivated Mushrooms.]—*Tijdschr. PlZiekt.*, xliv, 3, pp. 113–140, 8 pl., 1937. [English summary.]

In addition to the fungi mentioned in the writer's earlier paper on mushroom [*Psalliota* spp.] diseases in Holland, already noticed [*R.A.M.*, xvi, p. 653], the following organisms are discussed: *Pseudomonas tolaasi* [ibid., xvii, p. 378], found in Brabant, was controlled by reducing the temperature and adequately ventilating the beds, after sprinkling with water, so that no drops of water remained on the mushroom caps. *Dactylium dendroides* [ibid., xiv, p. 346] was found on mushroom beds in a nursery in 1937. *Chaetomium globosum* developed on straw in the compost and *Penicillium* sp. on the casing soil and on slow running spawn. 'Rose comb disease' [loc. cit.] was induced by the use of oil stoves or by the fumes of coal-tar creosote. Rust-coloured spots on the caps were due to irregular humidity either of the compost or of the atmosphere.

Beach (W. S.). **Control of Mushroom diseases and weed fungi.**—*Bull. Pa Dep. Agric.* 351, 32 pp., 6 figs., 1937. [Abs. in *Exp. Sta. Rec.*, lxxviii, 4, pp. 499–500, 1938.]

Investigations by the author demonstrated that mushroom houses can

be made sanitary by fumigation with formalin (3 lb. per 1,000 cu. ft.), by burning flowers of sulphur (2 lb. per 1,000 cu. ft.), or by spraying all inside surfaces with a fungicide. The treatment of the adjacent yards and composting ground with copper sulphate, mercuric chloride, or carbolic acid solutions is also recommended. Deposits of spent compost or waste mushroom fragments must be removed, and, before refilling, the houses that may be infected with diseases or weed fungi should be emptied, cleaned, and disinfected. Harmful fungi in compost are killed by heating to 130° or 140° F. [*R.A.M.*, xvii, p. 379], the installation of fans usually being essential to equalize the temperatures in the top and bottom beds. The soil used for casing should either be sterilized or obtained from uncontaminated sources. The temperature of the bearing beds should be maintained between 55° and 58° [ibid., xvii, p. 430]. An atmospheric humidity of 88 to 90 per cent. is desirable, and excessive moisture must be prevented by ventilation. Surplus moisture in the pinhead and button stages must dry readily if bacterial blotch [*Pseudomonas tolaasi*] and brown spot [cf. preceding abstract] are to be controlled. All good mushrooms in any area where a disease has started should be picked immediately, all infected ones removed, and the area sprayed with Bordeaux mixture (1–1–50 or 2–2–50) or treated with copper-lime dust containing 10 to 15 per cent. of monohydrated copper sulphate.

Control of weed moulds [cf. ibid., xvii, p. 92], especially white plaster mould [*Oospora fimicola*: loc. cit.] and olive-green mould [*Chaetomium olivaceum*: ibid., xvii, p. 379] depends chiefly on correct composting; the nearer the P_H is to neutral, the greater the probability of the spawn outgrowing the moulds.

Lafon (J.). **Étude, préparation et emploi d'un sel de fer efficace contre la chlorose.** [Study, preparation, and use of an iron salt effective against chlorosis.]—*Rev. Vitic., Paris*, lxxxix, 2300, pp. 65–68, 1938.

Chemical studies have shown that citric acid increases the controlling effect of iron sulphate on lime-induced vine chlorosis [*R.A.M.*, xvii, p. 291] by preventing the oxidation of ferrous sulphate to ferric, which is insoluble and thus unavailable to the plant; experience has further shown that standing for a few days improves the efficacy of the iron sulphate-citric acid solution, and that the action of the citric acid on iron sulphate is favoured by exposure to daylight. A concentrated solution of 1 part citric acid to 5 parts iron sulphate (by weight) may be evaporated in sunlight during summer, and the resulting residue, in the form of very fine, slightly green crystals, can be stored for use in the winter, when, re-dissolved, it is ready at once for application to pruning wounds.

Bonnet (A.). **Chronique. Traitement d'été des Vignes chlorosées.** [Current notes. The summer treatment of Vines affected with chlorosis.]—*Progr. agric. vitic.*, cix, 26, pp. 585–587, 1938.

The author obtained favourable results in 1937 in the treatment of vines against chlorosis by the application of 1 per cent. iron sulphate with 150 gm. citric acid per hectol. [see preceding abstract]. The spray is intended for vines not treated in winter or not benefited by such

treatment. It should be applied early in the summer, as soon as the first signs of discoloration appear, in which case the leaves begin to regain their normal colour in a few days. A second application should suffice to enable the leaves to regain complete normality; if, however, treatment is delayed until the leaves are quite yellow, the effects are only partial, and very slow.

BRANAS (J.). **Sur le court-noué. État actuel de la question.** [Note on court-noué. The present state of the problem.]—*Progr. agric. vitic.*, cx, 28, pp. 25–31, 1938.

The author states that all the evidence so far accumulated points to court-noué being the final stage of a virus disease of the vine, the initial stages of which are for the most part overlooked by the growers, chiefly owing to the fact that the precursory symptoms, such as 'panachure' [variegation] of the foliage, asymmetrical development and other malformation of the leaves, fasciation, and general disturbance of the normal phyllotaxy of the vine, have hitherto been regarded as physiological troubles or teratological phenomena. Before the introduction of *Phylloxera* [*vastatrix*: *R.A.M.*, xvii, pp. 222, 653] court-noué was rare and of no economic importance in Europe, since its distribution could only be brought about by cuttings from affected vinestocks, which were instinctively avoided by the cultivators; since then, however, the disease has been rapidly gaining ground and is now becoming one of the gravest menaces to viticulture in Europe. In his opinion the only means of controlling the disease is the careful extirpation of all infected and neighbouring healthy stocks to a distance sufficient to prevent the migration of the *Phylloxera* through the soil, all diseased material being immediately incinerated *in situ*. The soil thus cleared should be kept free from vine growth and either fallowed or used for non-susceptible crops for a period of years which still remains to be determined, but should not be less than three or four. Practice has shown that the control measures now in use, such as applications of carbon disulphide or flooding are either too expensive or only partly effective. State supervision of commercial vine nurseries is advocated to ensure that only healthy planting material is supplied by them.

MOREAU (L.) & VINET (E.). **La pression osmotique de la sève et les symptômes du court-noué chez la Vigne.** [Osmotic pressure of the sap and court-noué symptoms in the Vine.]—*C.R. Acad. Agric. Fr.*, xxiv, 21, pp. 709–714, 1938.

Volumetric measurements of the sap exuded by 18 vine stocks suffering from court-noué in the Angers district of France, where the disease may be due either to *Pumilus medullae* [*R.A.M.*, xvii, p. 432] or to adverse soil conditions, revealed a lowering of the osmotic pressure to an extent ranging from 2·5 to 68 in comparison with the normal figure, arbitrarily fixed at 100. Some suggestions are made for raising the osmotic pressure of the sap by cultural methods.

MARSAIS (P.). **Les maladies dues aux Botrytis et la viticulture.** [The diseases caused by *Botrytis* spp. and viticulture.] *Rev. Vitic., Paris*, lxxxix, 2303, pp. 145–148, 1938.

The author states that during the spring of 1938 considerable losses

were caused to young grafted vine plants in many French nurseries by a rot of the graft union tissues and young shoots, which is believed to have been caused by species of *Botrytis*. The main source of infection is thought to be the soil of the graft layering beds; it is recommended that such beds should be thoroughly disinfected before use, and that the rooted cuttings should be treated immediately on removal from them with some fungicide (e.g., 5 per cent. potassium sulphocarbonate for 30 minutes, or ortho-oxyquinoline) followed by washing in water.

Department of Scientific and Industrial Research. Report of the Food Investigation Board for the year 1937.—266 pp., 4 diags., 71 graphs, 1938.

The following are among the items of phytopathological interest in this report. In connexion with a study on egg moulds [cf. *R.A.M.*, xvii, p. 322], R. G. Tomkins found that the growth of *Rhizopus nigricans* on 2 per cent. malt agar at P_H 5 and on the same medium adjusted to 3·6 is reduced as the carbon dioxide concentration is raised. Growth on an alkaline medium is initially increased by the presence of small concentrations of carbon dioxide; on 2 per cent. malt agar+0·01 per cent. sodium bicarbonate, for instance, the development of the fungus is stimulated by carbon dioxide up to 10 per cent. and is about the same when 30 per cent. is present as in air. *R. nigricans* does not ordinarily grow on 2 per cent. malt agar+0·05 per cent. sodium bicarbonate, but will do so in the presence of 5 per cent. carbon dioxide. The maximum growth rate of the mould on this medium occurs with an admixture of 20 per cent. carbon dioxide. The practical interest of these data is that storage in concentrations of carbon dioxide up to 20 per cent. may, under certain conditions, encourage rather than inhibit mould growth.

T. Moran's experiments revealed no correlation between velocity of air current and the rate of mould growth on eggs, the latter being entirely dependent on the relative humidity of the atmosphere. At 95 per cent. perceptible infection became apparent after 27 days in both still and moving air (circulated at a uniform speed of 17 m. per minute), while at 90 per cent. the corresponding periods were 48 and 50 days, respectively.

F. Kidd and C. West found that a storage temperature range of 60° to 70° F. is the least conducive to breakdown in William's Bon Chrétien pears, while a high incidence of the trouble (54 per cent.) was observed after 173 days at 50°.

In experiments by A. S. Horne and R. G. Tomkins on the relation between resistance, mortality, and spore load in three lots of apples (from the Fen district, Kent, and the west of England), the addition of *Penicillium expansum* [ibid., xvii, p. 689] spores did not in any case increase wastage, the more extensive infection by this fungus being offset by a corresponding reduction in other rots.

Experiments by R. G. Tomkins showed that the amount of wastage from *P. digitatum* in wounded oranges (6 to 10 pricks to a depth of 1 mm. with pins stuck through a cork) may be reduced and retarded by storage in a reasonably dry atmosphere (70 per cent. relative humidity at 18° C.) [ibid., xiii, p. 112] or by ventilation with sufficiently dry air (50 per cent. saturation) as compared with saturated conditions. Within wide limits the rate of ventilation with saturated

air does not affect wastage. Restricted ventilation, allowing the accumulation of carbon dioxide up to 5 per cent. and simultaneously inducing conditions approaching saturation, does not increase wastage as compared with saturated air storage. The addition of 10 per cent. or more carbon dioxide may increase wastage by *P. digitatum* (up to 100 per cent. after 36 days in one test on South African Navels), while the introduction of 20 per cent. into the atmosphere is liable to cause browning of the skin and bitterness of flavour. Similar though less conclusive results were obtained in experiments on sound oranges.

A. S. Horne's experiments (with J. Colhoun) on variations in the reaction of the apple to fungal invasion associated with locality showed the average penetration of *Penicillium* (English isolation) through the lenticels following inoculations in December and February to be nearly three times as high (72·7 per cent.) for Kentish Bramley's Seedlings as for the same variety from Ulster (26·5), the corresponding figures for *Botrytis* (Irish culture) being 28·5 and 4, respectively. The *Penicillium* and *Botrytis* spots developed 5 and 15 days later, respectively, on the Ulster than on the Kentish fruit. In a later (March) test with *Botrytis*, the average penetrations for Kent and Ulster fruit were 30 and 14 per cent., respectively. In inoculations through punctures *Penicillium* spots developed in every case within 4 to 10 days. Similar results were obtained with *Botrytis* on Kentish fruit, but only 61 per cent. of the inoculations on Ulster apples were successful, developing after an average of 12 days. In a March test a higher value (83 per cent.) for *Botrytis* invasion was secured on Ulster fruit. As regards radial advance of *Penicillium* through the lenticels, the November and February averages for Kent were 0·675 and 2·332 mm. per diem and those for Ulster 0·405 and 1·482, respectively, the resistance of the Kentish fruit thus decreasing more rapidly with the passage of time than that of the Ulster samples.

In tests by the same author (with W. A. Roach), fruit from Bramley's Seedling trees injected with solutions of sodium phosphate, urea, sodium phosphate and urea, glucose and urea, and fructose and urea, was inoculated with *Cytosporina ludibunda* [ibid., xiv, pp. 40, 453]. The initial resistance to the fungus of the trees treated with sodium phosphate was not maintained. In general, urea tended to increase susceptibility, but in combination with fructose it produced anomalous results. Some indication was obtained that the result of the treatments is partially dependent on the time of application, the adverse effects of urea being more pronounced in fruit from trees injected in July than in August. The rate of invasion by *C. ludibunda* increased during 153 days' storage at East Malling by over 100 per cent., the difference of means between October (0·297 mm. per diem) and March (0·684) being $0·387 \pm 0·031$, and extremely significant.

J. Barker's studies on the storage of hothouse grapes showed that the Colmar variety is more susceptible to [unspecified] rots than the English Muscat. After a fortnight at ordinary temperature bunches picked on 11th November showed 10 per cent. decay, whereas those kept at 34° F. (with water-feeding) for a month and then at ordinary temperature for a fortnight, or for six weeks at 34°, were in good condition. English muscats stored at 34° with water-feeding kept well

for seven weeks but were slightly yellow after ten, while at ordinary temperature rotting progressed rapidly. Picking some time before maturity reduced the amount of storage rot in both varieties.

PADWICK (G. W.). **India: new plant diseases recorded in 1937.**—*Int. Bull. Pl. Prot.*, xii, 6, pp. 122–123, 1938.

The following plant diseases were observed for the first time in India in 1937: apple, eggplant, and peach rots due to *Rhizopus arrhizus*, *Phytophthora parasitica* [*R.A.M.*, xv, p. 633], and *Aspergillus japonicus* [ibid., xiv, p. 334], respectively, *Rhizoctonia bataticola* [?*Macrophomina phaseoli*] on orange roots [ibid., x, p. 308], and heart rot of *Picea morinda* (*Trametes pini*).

CONNERS (I. L.). **Seventeenth Annual Report of the Canadian Plant Disease Survey, 1937.**—xi+87 pp., 1938. [Mimeographed.]

In 1937 wheat stem rust (*Puccinia graminis*) caused heavy damage in the south-central and south-eastern parts of Manitoba, but injury was slight in other districts of western Canada [cf. *R.A.M.*, xvi, p. 589]. Infection appeared during the last few days of June, and spread rapidly throughout Manitoba and Saskatchewan, but severe drought prevented its further development.

Leaf blotch (*Helminthosporium tritici-repentis*) [ibid., xiv, p. 90; xvi, p. 231] caused a severe leaf wilt and spotting on durum wheat near Melita, Manitoba, this being the first record of the fungus on wheat in Canada.

A species of *Cryptoascus* was observed on wheat roots in Prince Edward Island in 1936 and 1937; it was also found on barley and oats.

Browning root rot of wheat (*Pythium* spp.) [ibid., xv, p. 639; xvii, p. 735], an important disease in Saskatchewan, occurred in severely epidemic form for the first time in Manitoba, being destructive to wheat on summer fallow in the Dauphin, Gilbert Plains, Grandview, Roblin, and Russell areas in June.

Red clover [*Trifolium pratense*] in New Brunswick was affected by mid-vein spot (*Mycosphaerella carinthiaca*) [ibid., i, p. 422; xvi, p. 229] in 1936, a new record for Canada, and probably for North America; *Ramularia trifolii* is the conidial stage.

Violet root rot (*Rhizoctonia crocorum*) [*Helicobasidium purpureum*] was recorded for the second time in Canada, when two affected potato tubers were received from Alberta; the disease occurred in only a few hills. Potato tubers apparently affected with dry rot (*Fusarium solani* var. *eumartii*) [cf. ibid., xvii, p. 700] were received from south-western Ontario; definite information that the disease had also occurred in 1936 was obtained, but the disease has not been recorded before in Canada. In the Prairie provinces potatoes are affected by a wilt of unknown cause characterized by the margins of the leaves on the upper parts of the plants becoming purple. It appears to be very similar to the wilt reported from Minnesota and Wisconsin [ibid., xvii, p. 409; cf. also xvii, p. 700]. Yellow dwarf [ibid., xvii, p. 701] was noted in Middlesex County, Ontario, chiefly on Dooley potatoes; the disease had been present for a few years.

A tomato disease, the symptoms of which agreed perfectly with Reddick's description (*Phytopathology*, x, pp. 528–534, 1920) of stem

girdle (*Phytophthora ? parasitica*), was found in a greenhouse at Grimsby, Ontario, this apparently being the first record of the disease in Canada.

Other new records for Canada include *Thyrostoma compactum* fruiting on dead elm twigs [ibid., xvi, p. 70] from Quebec and Ontario, a species of *Taphrina* very similar to *T. polyspora* found fruiting on leaves of *Acer rubrum* in Ontario, leaf spot (*Phytomonas geranii*) of *Geranium sanguineum* [ibid., xvi, p. 612] at Winnipeg, a virus-caused leaf curl of *Pelargonium* in Ontario [ibid., xvii, p. 684] (probably present for ten years), ink disease (*Mystrosporium adustum*) on the Imperator variety of iris [ibid., xv, p. 583] in British Columbia, *Coryneum microstictum* on roses [ibid., xvii, p. 323] in Ontario in 1929, and *Peronospora sparsa* on several varieties of roses [see next abstract] in British Columbia. Additional collections of *Coleosporium campanulae* on *Campanula* [ibid., xvi, p. 589; xvii, p. 602] were made in Ontario and Nova Scotia.

EASTHAM (J. W.). **Report of Provincial Plant Pathologist.**—*Rep. B.C. Dep. Agric., 1937*, pp. K43–K51, 1938.

During 1937 the only new disease of importance recorded in British Columbia was rose downy mildew (*Peronospora sparsa*) [*R.A.M.*, xvii, p. 752].

In a varietal resistance test the following winter wheats were strongly resistant to bunt [*Tilletia caries* and *T. foetens*] inoculum from the Okanagan valley: Albit×Hohenheimer, Hohenheimer×White Odessa 130 and 135, Hybrid 128×White Odessa, Hymar, Rex, Triplet×White Odessa, White Odessa×Hard Federation, and White Odessa×Dickkopf. Hussar and Oro, for many years very resistant, had 8·7 and 6·3 per cent. infection, respectively. That the Relief variety had 61·2 per cent. infection indicates that a new physiologic form has appeared in Northern Okanagan.

Locally, winter (not spring sown) wheats become infected by soil-borne spores, this form of infection being largely responsible for the bunted crop in 1937 and other years. Losses may be reduced by (1) seed treatment with ceresan, copper carbonate (50 per cent.), and leytosan; (2) early seeding (since bunt is reduced when the temperature from the day the wheat is seeded until it reaches the soil surface is over 55° F.), seeding in August or the first two weeks of September giving better control than seeding from 15th September to 15th October; (3) late seeding after 15th October; (4) delayed seeding three to four weeks after the first heavy autumn rains; (5) seeding before threshing time, which in the Okanagan valley gives virtually complete control; (6) substituting chemically treated spring wheat; and (7) growing resistant varieties of winter wheat, such as the fairly resistant Ridit, Oro, Hussar, White Odessa, and Jenkins×Ridit, though these will become affected in time and will require to be replaced.

Further tests again showed that Bordeaux mixture is slightly more effective against apple anthracnose [*Neofabraea malicorticis*: ibid., xvi, p. 797] than bouisol (4·5 pts. per 100 gals.).

MILBRAITH (D. G.). **Bureau of Plant Pathology.**—ex *Rep. Calif. Dep. Agric., 1937* (*Bull. Dep. Agric. Calif.*, xxvi, 4), pp. 533–539, 1938.

During 1937, the enforcement of celery-free periods in the vicinity

of Venice, California, as a means of controlling celery western mosaic [*R.A.M.*, xvi, p. 730], gave further improvement in yield, the quality of the crop being equal to normal.

Since the beginning of the eradication campaign against peach mosaic [loc. cit.; ibid., xvii, p. 301] in 1936, 62,401 diseased trees have been found and 32,009 diseased and 137,167 abandoned trees have been removed. On 1,717 properties inspected both in 1936 and 1937, there were 26,567 diseased trees in the former year, and 26,260 new infections in the latter, representing an apparent spread of 98·8 per cent., and probably an actual spread of at least 75 per cent.

Blight [*Endothia parasitica*: ibid., xvi, p. 730] was found in the two chestnut plantings previously reported as affected. There was a marked preponderance of infections at the base of the trunks near ground-level and spread apparently occurred through the irrigation water. There is no doubt that a general, mass infection took place in 1934–5, when several large, sporulating, aerial cankers were noted. Infection readily arose from these in the outer bark, where, under Californian conditions, it spreads very slowly, so that the cankers found in 1937 were probably held-over, quiescent infections. Eradication is in progress.

Chargaff (E.) & Levine (M.). **The lipids of Bacterium tumefaciens.**—*J. biol. Chem.*, cxxiv, 1, pp. 195–205, 1938.

Full details are given of the procedure adopted by the authors in their study at the Montefiore Hospital, New York, of the composition of *Bacterium tumefaciens* [*R.A.M.*, xvi, p. 798] and the results obtained in the isolation of fat, phosphatide, and polysaccharide fractions from the organism are described. The fat fraction was found to consist of glycerol, sterols, palmitic and oleic acids, a new saturated liquid acid, and a complex mixture of higher unsaturated fatty acids.

Locke (S. B.), Riker (A. J.), & Duggar (B. M.). **Growth substance and the development of crown gall.**—*J. agric. Res.*, lvii, 1, pp. 21–39, 5 figs., 1938.

The results of experiments, in which tomato, *Sedum*, *Bryophyllum pinnatum*, and *Kalanchoë diagremontiana* plants were inoculated with single-cell sister crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) cultures, showed that the plants inoculated with the virulent strain of the organism exhibited, in addition to development of galls, (1) increased epinasty of leaf petioles, (2) increased initiation of adventitious roots, (3) stimulated cambial activity, (4) inhibited development of certain buds, and (5) delayed abscission of senescent leaves, responses suggesting an increase in the amount of growth substances present [ibid., xvii, p. 659]. An attenuated sister strain was less effective in inducing most of these reactions, as well as in bringing about gall development. Inoculation of decapitated tomato plants on the wound surface with the attenuated culture stimulated the development of adventitious shoots. Determinations by Went's *Avena* tests (*Rec. Trav. bot. néerland.*, xxv, pp. 1–116, 1928) indicated that the tissues of inoculated tomato seedlings contained greater amounts of growth substance than the comparable tissues of uninoculated seedlings, but the amounts detected were equivalent to only a minute fraction of the amount commonly

used in the β-indoleacetic acid treatment for the production of proliferations in the bean [*Phaseolus vulgaris*]. In preliminary experiments no relation could be established between the ability of the virulent and attenuated cultures to produce growth substance in culture and their ability to induce galls in plants. In experiments on tomato plants growth substance from expanding leaves slightly stimulated the development of the galls induced by the attenuated strain, while that from gall tissue induced by the virulent strain had a strong stimulating effect on tissue inoculated with the attenuated strain. *B*-indoleacetic acid was only slightly effective in this respect.

Reviewing the available evidence the authors reserve judgement about β-indoleacetic acid playing a major part in the development of crown gall. The chief growth substance so far detected in crown gall is more probably of the auxin-a or auxin-b type than of the hetero-auxin type and is more likely a product of the host cells under the influence of the bacteria than a direct bacterial metabolic product.

Magrou (J.). **Contribution à l'étude de l'immunité humorale chez les plantes.** [A contribution to the study of humoral immunity in plants.]—*Ann. Inst. Pasteur*, lx, 6, pp. 565–600, 2 pl., 1938.

A detailed, fully tabulated account is given of the writer's experiments at the Pasteur Institute, Paris, to determine the nature of the humoral reactions of plants inoculated with *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xvi, p. 660; xvii, p. 448].

The expressed juice of *Pelargonium zonale* and *Chrysanthemum frutescens* tumours induced by the crown gall organism was found invariably to effect complete agglutination of aqueous suspensions of pure cultures of the bacterium at dilutions of up to 1 in 10,000 in the case of the latter plant. In four out of five tests the same phenomenon was produced by the juice of the leafy stems of these two plants. Juice from uninoculated *P. zonale* and *C. frutescens* plants also agglutinated *Bact. tumefaciens*, but only within a very restricted range of dilutions. The juices lose their agglutinative capacity on heating to 100° C. *P. zonale* and *C. frutescens* juices, whether extracted from tumours, tumour-bearing stems, or healthy plants, do not agglutinate *Phytomonas* [*Bact.*] *malvacearum*, *P.* [*Bact.*] *flaccumfaciens*, *P.* [*Bact.*] *mori*, or *Erwinia carotovora*. Extracts of all these organisms, as well as of *Bact. tumefaciens*, are precipitated by the juice of tumours and tumour-bearing stems of *C. frutescens*, but not by that of healthy plants. The power of precipitation is attenuated by heating to 85°. The juice of *Pelargonium zonale* tumours also precipitates extracts of *Bact. tumefaciens*, but less thoroughly and constantly than that of *C. frutescens*.

P. zonale plants bearing developing crown gall excrescences are stated to be partially or totally immune from reinfection by the same organism, but their freedom from invasion by *Bact. tumefaciens* is accompanied by hypersensitivity assuming the form of local or generalized intoxication.

It is evident from these data that crown gall infection involves a general modification in the internal constitution of the plant which can be studied by the aid of serological methods [ibid., xvi, p. 660]. The phenomena of bacterial agglutination and precipitation of their ex-

tracts by the diseased plant juices are considered to present analogies with the immunological reactions observed under comparable circumstances in the animal world. Agglutinins may already be present in uninfected plants, but if so their properties are modified by the first inoculation with antigen. On the other hand, precipitins are discernible, at any rate by the current methods of technique, only in infected plants. The existence of antibodies is revealed *in vivo* by the state of hypersensitivity accompanying immunity from reinfection in inoculated plants.

Dame (F.). **Pseudomonas tumefaciens (Sm. et Towns.) Stev., der Erreger des Wurzelkropfes, in seiner Beziehung zur Wirtspflanze.** [*Pseudomonas tumefaciens* (Sm. & Towns.) Stev., the agent of crown gall, in its relation to the host.]—*Zbl. Bakt.*, Abt. 2, xcviii, 21–24, pp. 385–429, 18 figs., 1938.

Contrary to E. F. Smith's observation (Bacterial diseases of plants, p. 413, 1920) that the proliferations induced by *Pseudomonas* [*Bacterium*] *tumefaciens* originate in a single cell of the host, the writer's inoculation experiments with the crown gall organism on sunflower (*Helianthus annuus gigantea*) at the Horticultural Institute of the Friedrich Wilhelm University, Berlin, showed that several cells are invariably involved in the inception of the tumours, even when only one is wounded.

In experiments on Flageolet St. Andreas beans [*Phaseolus vulgaris*], Lucullus tomatoes, sunflowers, apple and pear seedlings, and *Datura*, tumour-like proliferations were induced by minute quantities of β-indoleacetic acid and β-indolebutyric acid [*R.A.M.*, xvii, p. 658]. At higher concentrations (e.g., 0·5 per cent. and upwards) these substances stimulated the vigorous development of adventitious roots, a result conflicting with the observations of Nellie A. Brown and Gardner in this respect [ibid., xv, p. 782; xvii, p. 224]. Similar manifestations of a less pronounced character followed the inoculation of bean, *Datura*, and tomato plants with ether extracts from tumours and cultures of *Bact. tumefaciens* (Stapp's *Dahlia variabilis* strain) [ibid., xvi, p. 302]. These excrescences arose from the cambial tissue, whereas those due to direct inoculation with the organism at first involved only the injured and adjacent cells.

Hormone formation was found to be an exclusive property of virulent strains of *Bact. tumefaciens* [cf. above p. 799], such as Smith's from hops, Stapp's from *D. variabilis*, and the writer's from apple. The phenomenon was stimulated by the incorporation in the medium of high-molecular nitrogen compounds, especially tryptophane.

A limited degree of immunization was obtained in tests on *Datura* and tomato by infiltration (by means of glass tubes drawn out to a capillary and inserted in the stem) with suspensions of an avirulent strain of *Bact. tumefaciens* (Riker's from blackberry) or rabbit antisera (1 : 1 and 1 : 5).

In a series of tests on the reaction of a large number of apple, pear, and quince strains used as nursery stocks to infection by the uniformly virulent hop isolation of the crown gall organism, a marked degree of resistance was shown by the Northern Spy apple variety, three

clones (Dab 104, 114, and 400) of *Malus* [*Pyrus*] *baccata* var. *aurantiaca*, and three of the quince types (E[ast] M[alling] B, F, and G), but all the pear clones were susceptible.

POUND (F. J.). **Cacao and witchbroom disease (Marasmius perniciosus) of South America. With notes on other species of Theobroma. Report by Dr. F. J. Pound on a visit to Ecuador, the Amazon Valley, and Colombia. April 1937–April 1938.**—58 pp., 1 map, Youille's Printerie, Port-of-Spain, Trinidad, 1938.

The writer gives an account of his visits to Ecuador [*R.A.M.*, xvii, p. 99] and later to the Amazon Valley in search of strains of cacao resistant to the witches' broom disease (*Marasmius perniciosus*) [ibid., xvii, p. 728]. The disease was found to be rampant throughout the whole of the Amazon Valley, including the tropical plain drained by the headwater tributaries, extending into Bolivia, Peru, Ecuador, and Colombia. In Ecuador the high-grade 'Nacional' cacao was found to be susceptible to the disease; the 'Venezuelan' cacao introduced from Trinidad about 1890 seemed on the whole to be equally susceptible to witches' broom (and also to *Monilia* [*roreri*: ibid., xiii, p. 360]), yet occasional 'Venezuelan' trees developed resistance. On the whole there exist in Ecuador well over 1,000,000 resistant cacao trees and the resistance seems to be often linked with the white pod type of tree.

In the Amazon Valley, on the Rio Nanay 14 trees all of the same type with either completely unpigmented or half white, oval, only slightly warty pods were found to be entirely free from disease, in spite of heavily infected trees growing near them. The strong resemblance of the pods of these trees to those of the above-mentioned resistant type of tree in Ecuador suggests the possibility of the latter trees being of Amazon Valley origin. Occasional resistant trees were found to belong to a type designated 'lagarta', with long, warty, bottle-neck pods, or to a third group, characterized by small, oval, warty pods. On the Rio Marañon some twenty trees free from disease had the 'lagarta' type of pod, either full white or pure green. On the Rio Ucayali only the green 'lagarta' type occurs and was also found to segregate resistant trees. In the Belem district and Rio Tocantins cupuassu trees (*Theobroma grandiflorum*) were observed to be very heavily infected by the disease whereas cacao trees (of a type labelled 'Para', characterized by an unpigmented half blanco pod, with a bottle-neck, long, oval body, warty surface, and a definite point) were reasonably free from infection except when growing in their vicinity. Many young cacao trees of this type grown in full sunshine were observed to remain uninfected, while those growing in shade showed some disease. Cacao trees of a type known to be susceptible were found to be healthy at altitudes of over 3,000 ft. in the Colombian Cordilleras, while for ten years the disease has been known to occur on the coastal plain around Tumaco not far distant. The high altitude would therefore appear to have prevented the development of the disease unless one assumes that it has been shut off by the mountain barrier. Of the varieties of non-commercial cacao described the self-compatible *T. speciosum* group appears to be immune from witches' broom and also from *Phytophthora faberi* [*P. palmivora*]

Pods and budwood of suspected highly resistant cacao types and of immune non-commercial varieties collected on this journey have been sent to Barbados for propagation in quarantine, with a view to being budded later on seedlings in Trinidad and submitted to further tests and studies.

GRACE (N. H.). **Effect of phytohormones on seeds damaged by formaldehyde and other disinfectants.**—*Canad. J. Res.*, Sect. C, xvi, 8, pp. 313–329, 1 pl., 1938.

An account is given of experiments made to test the hypothesis recently advanced by A. W. Henry (*20th Ann. Rept.* (*1936–7*) *Nat. Res. Counc. Canada*, p. 85, 1938) that the deleterious effect of formalin disinfection on the germination and growth of cereal seeds is due, in part, to the tendency of formaldehyde to inactivate the growth hormone, heteroauxin. In his experiments the author tested the effect of the addition of two plant hormones, namely, 1-naphthylacetic acid or 3-indolylacetic acid, to the formalin or copper sulphate solutions or to hot water, used for the disinfection of a number of cereal seeds, including low-grade commercial wheats. The results showed that the injury to the seeds, as measured by percentage germination and by the relative length of the seminal roots and stems, is largely overcome by the addition of either substance, the optimum concentration of the hormone varying for individual varieties of cereals between 0·01 and 5 parts per million (by weight). Higher concentrations of the hormone may bring about a significant drop in the useful effect of the treatment, indicating the overdosage phenomenon characteristic of plant response to these active chemicals. There was also evidence that improvement in germination and early growth from the use of formaldehyde-hormone solutions is independent of the polymer content of the formaldehyde, and that the formaldehyde-hormone solutions may be stored for at least 10 weeks without loss of activity.

The results of a further series of experiments suggested that the response of formaldehyde-injured seeds to chemicals may be used to determine the physiological activity of the latter. Among the substances tested with No. 5 special wheat, the greatest reduction in damage was effected by naphthylbutyric acid, phenylacetic acid gave somewhat less protection, vanillin and methoxysalicylaldehyde were intermediate in effect, and benzoic acid and piperonal showed activity of a lower order. Pyrroleacetic acid appeared to have no effect.

[A brief summary of this paper is published in *Nature, Lond.*, cxlii, 3584, p. 77, 1 fig., 1938.]

DÉFAGO (G.). **Pour une meilleure connaissance et un contrôle plus efficace de la carie du Blé en Suisse romande.** [For a better knowledge and more effective control of Wheat bunt in Romansh Switzerland.]—*Bull. Murith.*, lv, pp. 78–116, 1 fig., 1 graph, 1938.

Inoculation experiments with collections of spores of wheat bunt (*Tilletia tritici*) [*T. caries*] from various parts of Romansh Switzerland, where the disease has recently become active, showed that all the chief

spring and autumn varieties grown in this locality are highly susceptible, except the somewhat resistant Alpha and Plaine.

The collections of *T. caries* obtained from the different areas were found to represent 'populations' differing in pathogenicity, specialization, colour, and length of basidiospore, but not in the dimensions of the chlamydospores or the modifications produced in the host. The 'populations' consisted of heterogeneous mixtures of individuals which hybridized before penetrating the host. These individuals fell into distinct groups differing in virulence and in spore colour and shape. Such groups remained relatively constant. Infections with mixed populations gave rise to less bunt than inoculations with separate populations, indicating that high virulence is recessive in *T. caries*. Haploid isolations were distinguished from one another by fairly constant cultural characters, which were not, however, specific for any one population. Chlamydospore germination was greatly increased by abrupt changes in temperature, which may partly explain why sowings made late in autumn or early in spring are most liable to infection. The optimum temperature for *T. caries* in culture was about 21° C., and that for *T. foetens* about 18°, the maximum for both species lay between 24° and 27°, the minimum being less than 0° for *T. caries* and between 0° and 3° for *T. foetens*. The fact that *T. foetens* is restrained by low temperatures more markedly than *T. caries* may explain why the former is found especially in warm countries and continental countries sowing almost exclusively spring wheats.

Seed treatment with formalin (0·1 per cent., 20 minutes' immersion) alone gave a completely disease-free crop without impaired germination; dusting, except with organic mercury dusts, gave less beneficial results.

GUARD (A. T.). **Studies on cytology and resistance to leaf rust of some interspecific and intergeneric hybrids of Wheat.**—*Amer. J. Bot.*, xxv, 7, pp. 478–480, 2 figs., 1938.

In these studies hybrids between Chinese wheat C.I. 6223 (*Triticum vulgare*), which is very susceptible to leaf [brown] rust (*Puccinia triticina*), and the highly resistant species Vernal emmer S.D. 293 (*T. dicoccum*), Abbruzzes rye (*Secale cereale*), and *S. montanum*, respectively, were grown in the greenhouse and inoculated in the seedling stage with *P. triticina* (physiologic race 65). Of the 24 lines from crosses between Chinese wheat (haploid chromosome number 21) and Vernal emmer ($n = 14$), selected in the third generation and studied in the fourth and fifth, 7 lines had a haploid chromosome number of 14 and 17 a haploid chromosome number of 21. All lines with 14 chromosomes were as resistant to brown rust as the pollen parent; of those with 21, 11 were resistant and 6 highly susceptible. The hybrid between Chinese wheat and an inbred self-fertile strain of Abbruzzes rye (n=7) was an amphidiploid and was highly resistant. The fertility of the plants of the F_3 and subsequent generations varied from 5 to 75 per cent., depending largely on environmental conditions, especially at the time of flowering. Meiosis showed only minor irregularities. Fifteen F_1 hybrids between Chinese wheat and *Secale montanum* (n=7)

were sterile. All F_1 plants were highly resistant. Meiosis was very irregular and no viable pollen was produced.

HOLTON (C. S.). **A simple method of inoculating Wheat seedlings with paired monosporidial lines of Tilletia tritici and T. levis.**—*Phytopathology*, xxviii, 7, pp. 518–520, 1 fig., 1938.

The following technique, based on Buller and Vanterpool's observation of the violent discharge of the basidiospores (secondary conidia) of *Tilletia tritici* [*T. caries*: *R.A.M.*, xii, p. 777], has been devised for the simple and expeditious inoculation of wheat seedlings with paired monosporidial lines of this fungus and *T. levis* [*T. foetens*]. A fragment of mycelium from each of the two lines to be combined is placed near the edge of a Petri dish containing potato dextrose agar. As soon as growth starts, the dish is turned on edge, with the side bearing the mycelial colonies uppermost, and incubated in this position at 10° to 18° C. As growth proceeds, the secondary sporidia are discharged, and, coming to rest on the agar, form a mycelium, which in turn gives rise to more sporidia. A part of the agar surface thus becomes covered with the sporidia and mycelium of the two lines and is ready for use as inoculum. Surface-sterilized wheat grains are placed on moist sterile filter paper in the inverted lid of the Petri dish and covered with the inverted culture; the whole is then incubated at 10° for 10 to 14 days, during which time the secondary sporidia fall on the seedlings and germinate. At the end of the period of incubation the seedlings are transplanted, preferably as a group, to the greenhouse or field. In one of the series of inoculations made by this method during the last two years, 26 out of 74 monosporidial line combinations produced 1 to 57 per cent. infection (over 20 per cent. in most cases).

CHURCHWARD (J. G.). **Studies on physiologic specialization of the organisms causing bunt in Wheat, and the genetics of resistance to this and certain other Wheat diseases. I. Physiologic specialization studies.**—*J. roy. Soc. N.S.W.*, lxxi, pp. 362–384, 3 figs., 1938.

In the experiments described in this paper 16 collections of wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] from widely separated centres (nine from Australia, six from the United States, and one from Wales) were studied on 11 varieties of wheat at St. Paul, Minnesota, in 1932. Four of the wheats, Kota, Progress, Preston, and Red Bobs, acted as differentials and these were used in repeat inoculations at Hawkesbury Agricultural College, New South Wales, in 1933. The percentage infection was calculated from about 200 head counts and the results are tabulated. In addition to the races of *T. caries* described by Reed, three others appear in the Australian collections and four of *T. foetens*.

Of the new races of *T. caries*, race 1 is able to infect Kota, Progress, and Red Bobs wheats, the first-named being the most susceptible. In 1932 it produced a reaction similar to that of Reed's T_2 collection [*R.A.M.*, vii, p. 369] but in 1933 it differed in attacking Preston more severely. Race 2 infected only Kota and race 3 attacked Kota, and to some extent Progress, Preston (in 1933 only), and Red Bobs (1933). Of the new races of *T. foetens* race 1 infected Red Bobs, and to a less extent

Progress; race 2 was weakly parasitic on Kota; race 3 infected Kota, and to a less extent Red Bobs and Progress; and race 4 infected Kota, and to a less extent Progress, but not Red Bobs. No differences were observed in the size of the chlamydospores or in the size, shape, and consistency of the bunt balls, or in the cultural characters of the various collections.

In 1935–6, the experiments were continued, using the seven new Australian races and 72 collections of bunt from different parts of the world. The reactions of the differentials were similar to those obtained with the same races used in the earlier tests, with three exceptions: in 1935, Preston was not attacked by T_2 or race 3 of *T. caries*, but in 1936 was heavily infected by them. Progress, attacked by T_1 in 1936, had a relatively small percentage of bunt in 1935. Of the 72 collections from places outside Australia, 41 gave constant reactions and 31 were variable. The 41 collections fell into 11 groups according to the reactions of the four differential varieties. Of the Australian races established in the earlier experiments, however, races 1, 3, and 4 of *T. foetens*, and race 3 of *T. caries*, corresponded, respectively, to types 1, 9, 4, and 6 already described.

HYNES (H. J.). **Studies on Helminthosporium root-rot of Wheat and other cereals. Part 3. Factors influencing infection. Part. 4. The control problem.**—*Sci. Bull. Dep. Agric. N.S.W.* 61, 67 pp., 15 figs., 2 graphs, 1938.

In this further account of his studies of the cereal root rot problem in New South Wales [*R.A.M.*, xiv, p. 621; xvi, p. 735; xvii, p. 306] the author states that under glasshouse conditions pre-emergence blight of wheat seedlings due to *Helminthosporium sativum* was pronounced in soils held at high (60 to 65 per cent.) and low (30 per cent.) moisture contents, while in both series emergence was slower and more irregular in the inoculated than in the uninoculated soil. The infected seedlings were conspicuously stunted. These features were more apparent in the high- than in the low-moisture series.

In two series of inoculation experiments on wheat seedlings with *Helminthosporium* M [*Curvularia ramosa*], *H. sativum*, and *Fusarium* sp. (in series A), and *H. sativum*, *Ophiobolus graminis*, *Fusarium* sp., and *Penicillium* sp. (in series B) singly and in various combinations, pre-emergence blight was greater with all the organisms tested in soil at 60 than at 30 per cent. water-holding capacity, but the difference in the amount of blight at high and low soil moisture varied widely for individual organisms and combinations of them. In series A, at 30 per cent. water-holding capacity, pre-emergence blight was greatest when all three fungi were combined. At the higher soil moisture content injury was greatest when the fungi were paired in various combinations or all associated together. In both the wet and dry series, stunting was greater in soil inoculated with two or three organisms than with only one; it was greater in the high- than in the low-moisture series. In series B, the greatest reduction in emergence at both high and low moisture contents occurred when all four fungi were associated, while stunting was most marked in the low-moisture set containing the four organisms. Pre-emergence blight was rather greater in the high- than

in the low-moisture set, but the growth of the surviving seedlings was better under the moister conditions.

In outdoor pot tests, rather more pronounced pre-emergence blight in wheat occurred when *C. ramosa* and *H. sativum* or *H. sativum* and *F. culmorum* were combined than when each was used alone, the most severe injury of all resulting when all three organisms were associated.

The data (analysed statistically and correlated with air temperature readings) obtained in experiments conducted during three years on the influence of temperature on infection of wheat seedlings by *H. sativum* showed appreciable reduction of emergence each year in the inoculated plots of early, mid-season, and late maturing varieties planted at the correct time, though there was one exception, due to low temperature; in each year reduction was greatest when the wheat was sown early. From 1927 to 1932, *Helminthosporium* root rot of adult wheat at Bathurst was most marked when the Meyer ratio of precipitation to absolute saturation deficit was relatively low from August to October. From 1924 to 1933, the disease was usually most severe in different parts of New South Wales when the rainfall was high or low during the growing period (April to October).

Controlled greenhouse experiments in 1931 demonstrated that *H. sativum* root rot in adult wheat developed only in series in which the soil moisture content was maintained at 30 per cent. water-holding capacity during the first three months of growth and then changed to and kept at 65 per cent. until maturity. Further tests showed that when the soil moisture content during the pre-ear-peeping stage was high the parasitism of *H. sativum* was negligible, whether the moisture content in the post-ear-peeping stage was high or low [ibid., xvii, p. 306]. The pathogen may be carried by the seed internally or externally and treatment of the seed-grain with disinfectants is of doubtful value. The application of superphosphate under certain conditions minimizes pre-emergence blight, but fallowing and suitable crop rotations are the best methods of control. The relative prevalence of *Helminthosporium* or *Fusarium* on the basal parts of wheat is not significantly affected by the type of crop sequence, and the beneficial effect of rotation is due to increased ability of the host to withstand attack rather than suppression of virulence in the parasite. Biological antagonism is not so important a factor with *H. sativum* as with *O. graminis*. Frosts, sheep-grazing, or excessive moisture fluctuations frequently result in severe outbreaks of disease which are likely to be moderated if crops are sown on well-consolidated land and on land containing adequate organic matter.

Pratt (R.). **Respiration of Wheat infected with powdery mildew.**—*Science*, N.S., lxxxviii, 2272, pp. 62–63, 1 graph, 1938.

The results of the experiments briefly described in this note showed that the respiration rate of Marquis wheat seedlings infected with powdery mildew (*Erysiphe graminis tritici*) and kept at 20·5° C. rose rapidly and reached a maximum value 2·5 to 3 times that of the controls in about nine days; it was maintained at a high value for about a week, and then began to decline, finally falling considerably below that of the controls. This increase in the rate of respiration is not

attributable to respiration of the parasitic fungus [cf. *R.A.M.*, xiv, p. 174] since leaves dusted with sulphur showed little decrease in respiration.

HONECKER (L.). **Über die physiologische Spezialisierung des Gerstenmeltaues als Grundlage für die Immunitätszüchtung.** [On the physiologic specialization of Barley mildew as a basis for breeding for immunity.]—*Züchter*, x, 7, pp. 169–181, 5 figs., 1938.

A fully tabulated account is given of the writer's continued studies at the Bavarian Plant Breeding Institute on physiologic specialization in barley mildew (*Erysiphe graminis*) in relation to breeding for immunity from this disease [*R.A.M.*, xvi, p. 804]. Nine physiologic races of the fungus (A to J) were used in inoculation experiments on a standard assortment of eight varieties and a further selection, some of which present a certain interest as potential parents in view of their more or less favourable reactions to two rusts (*Puccinia glumarum* race 23 and *P. simplex* [*P. anomala*] race 15) [ibid., xvii, p. 231].

In order to obtain sufficient inoculum of races B to J, it was necessary to adopt the so-called 'trap' method, consisting in the cultivation, in the midst of large susceptible stands, of small plots of varieties immune from the predominant A but reacting in various ways to the other races. Thus, Weihenstephan CP 127,422 serves as a 'trap' variety for race B and Ragusa DR 34–40 for C and D. The races B and D are the only ones besides A to which the slightest practical importance attaches.

Of the eight varieties comprising the standard assortment, only Hohenfinow four-rowed summer barley proved highly susceptible to all nine races, while *Hordeum spontaneum nigrum* was immune from all except the supposed mutant F. CP 127,422 was immune from races A, H, J, and D but highly susceptible to B, G, C, E, and F. Gopal C.I. 1091 showed marked resistance to all the races, while the remaining standard varieties reacted in different ways. Of the other varieties tested, Goldfoil, Hanna, Pflug's Intensiv, CP 127,422 and four more selections of the Plant Breeding Institute, all completely or virtually immune from *P. glumarum* and *P. anomala* and highly resistant to, or immune from, *E. graminis*, may be recommended as parents primarily for brewing barleys, while three Ragusa selections (DR 350, 6–9, and 14) are of interest in the work of winter barley selection. The descendants of such highly resistant varieties as *H. s. nigrum*, Gopal C.I. 1093, Nigrate C.I. 2444, Arlington C.I. 702, Zulu C.I. 1022, and Austral 22 would doubtless be totally or practically immune from all the known races of mildew, but their use as progenitors is limited by certain morphological and physiological departures from the prevailing standards necessitating protracted back-crossing to produce acceptable results. Varieties combining a fair degree of resistance both to mildew and the two rusts (of which *P. anomala*, with its many biotypes, constitutes a much more complex problem than *P. glumarum*, so far represented in the field exclusively by race 23) include Bolivia C.I. 1257, Weiden C.I. 1021, Zulu C.I. 1022, and Austral 22; these may prove useful as parents in the development of summer barleys.

The inheritance of the various factors conferring immunity or resistance may be mono-, di-, or polymerous according to the barley

variety and physiologic race of mildew involved, so that resistance appears either as a dominant, recessive, or intermediate character. As a rule, immunity is transmitted monomerously and the varying shades of resistance polymerously, the latter process giving rise to complex segregation ratios. For practical purposes, however, the geneticist's work is simplified by the fact that the resistance of certain barley varieties to several races of *E. graminis* is conditioned by the selfsame factor (group resistance), so that tests on hybrid progenies with one race will indicate the reaction of such populations to the entire group of races concerned.

SAMPSON (K[ATHLEEN]) & WESTERN (J. H.). **Biology of Oat smuts. V. A ten years' survey of six spore collections. Propagation, screening and monospore isolation experiments.**—*Ann. appl. Biol.*, xxv, 3, pp. 490–505, 1 pl., 1938.

Details are given of the authors' studies over a period of ten years on the behaviour and relative stability on the differential hosts of three physiologic races each of *Ustilago avenae* and *U. kolleri* [*R.A.M.*, xv, p. 711]. The authors explain that there are three methods of treating smut collections to bring them nearer to purity of type. The first is the use of differential host varieties in screening experiments. From a mixture of two types it should be possible, if hybridization does not take place, to screen out one type completely by inoculating the grain of two differential hosts; if the smuts hybridize, the effect of screening will depend on the behaviour of the heterozygous dikaryophyte. The second method is to isolate a single chlamydospore, grow it in culture, and inoculate seedlings; the purity of the smut population will then depend on the genetic constitution of the chlamydospore. The third method (not used in these tests) is to start the cultures from paired sporidia from one chlamydospore.

The results showed that, for the L_2 race of *U. avenae*, screening soon resulted in the loss of its capacity to attack *Avena strigosa*. By monospore isolations the C_2 race of *U. kolleri* was resolved into two types, one of which remained unchanged, while the other had a narrower range of infection than the parent collection, and failed to infect *A. strigosa*. Monospore isolations of the C_4 race of *U. kolleri* also yielded two types, one of which was more and the other less pathogenic than the collection as a whole. It is believed that these changes may most probably be explained by the assumption that the heterozygous condition persisted through a number of chlamydospore generations produced in the host plant, and this probably limits the efficiency of screening experiments as a means of obtaining races genetically pure for pathogenicity characters. No changes were observed in the other three races (L_{11} and L_{12} of *U. avenae* and C_1 of *U. kolleri*). A study of the cultural characters of monospore lines showed the absence of any distinction between *U. avenae* and *U. kolleri*, the absence of any correlation between pathogenicity and growth in culture, and the extraordinary uniformity of monospore cultures within the collection L_{11} of *U. avenae*. In further experiments monosporidial lines of L_{11} in culture also showed, in contrast to L_2, almost perfect uniformity, indicating absence of segregation in definable characters. No success was

encountered in a special series of experiments designed to break down the resistance to smut in certain selected oat varieties.

MUSKETT (A. E.). **A Study of the epidemiology and control of Helminthosporium disease of Oats.**—*Ann. Bot., Lond.*, N.S., i, 4, pp. 763–784, 2 pl., 4 diags., 2 graphs, 1937.

The author undertook this study of the epidemiology of *Helminthosporium avenae* on oats with a view to evolving a standard technique for the evaluation of seed disinfectants [*R.A.M.*, xvii, p. 261, and next abstract] which would be more accurate and speedy than field trials. In pot experiments in 1934–5 oat seedlings were raised from infected seed of the Potato variety under varying controlled conditions of soil type, soil moisture, and soil temperature. The experiments were concluded when the second leaf was as long as the first, this being the stage of the maximum incidence of the primary phase of the disease. Soil temperature was found to be the chief factor governing the incidence of the disease. Within a range of temperatures likely to occur in a normal spring (6·6° to 13° C.) the incidence and the intensity of the disease decreased progressively under wet and moist soil conditions with a rise in the mean temperature. The disease was more severe in dry soil and did not decrease with the rise of temperature, soil moisture acting as a limiting factor. In an experiment with a sample containing 60 per cent. infected seeds, 56 per cent. of the seedlings were diseased on cold, dry soil and only 15 per cent. on wet and warm soil. The incidence of the disease generally decreased with improved conditions for rapid growth of the plants. The type of soil had little influence on the incidence of the disease apart from the effects derived from its warmth- and moisture-retaining properties. The pre-emergence phase of the disease was most marked under cold, wet conditions of growth, and also showed a tendency to occur under high temperatures on dry soil. The results obtained were the same for both heavily and lightly infected seeds. Seed disinfection before sowing with an organic mercury dust of proved value gave almost perfect control of the disease under all conditions except in the case of dry soil and high temperature. The results of this study indicate that the best conditions for testing the value of seed disinfectants occur in plants grown at a mean soil temperature of 8° to 10° (coinciding with a very high incidence of the post-emergence phase of the disease) and soil moisture of 50 per cent. saturation. It appears desirable, furthermore, to repeat the test under conditions of dry soil (25 per cent. saturation) and high temperature (12° to 13° C.).

MUSKETT (A. E.). **Biological technique for the evaluation of fungicides. I. The evaluation of seed disinfectants for the control of Helminthosporium disease of Oats.**—*Ann. Bot., Lond.*, N.S., ii, 7, pp. 699–715, 1 pl., 1938.

Three biological methods for determining the value of seed disinfectants for the control of *Helminthosporium avenae* on oats were tested in Northern Ireland over a period of three years [see preceding abstract]. The laboratory method is described as follows. Seeds (100) treated with the disinfectant under investigation are arranged with equidistant

spacing in Petri dishes lined with moistened filter paper and the dishes placed in an open container and covered with moist cloths. After incubating at about 22° C. for three days the seeds are irradiated on the fourth day for 20 minutes, using a Hanovia quartz mercury vapour lamp 1 ft. from the dishes, and replaced in the incubator until the ninth day, when they are examined for the presence of conidia of *H. avenae*.

In the pot culture method oat seedlings from seed samples under investigation are raised in two parallel tests (soil at 50 per cent. saturation and a temperature of 8° to 10° for the first test and soil at 25 per cent. saturation and a temperature of 12° to 14° for the second) to the stage where first and second leaves are of equal length, when the seedlings are cut off and examined, and the disease assessed by the presence of 'stripe' lesions. The first test lasts for about 40 to 50 days; the second 30 to 40 days.

The field method consists in sowing the disinfected grain under field conditions in five replications in plots covered with wire netting and examining the seedlings when the symptoms of the disease have become fully apparent. The test lasts from 31 to 42 days. The sample of seed oats to be tested should contain at least 15 per cent. of grains infected with *H. avenae*. Those materials which satisfy the conditions of the laboratory test should be subjected to the two pot trials and the field test. A high degree of correlation has been found to exist between the results obtained by the three methods. It is tentatively suggested that a satisfactory fungicide should not allow more than about 0·2 per cent. disease to be found in the pot and field trials.

Of the fungicides tested, the proprietary materials containing organic mercury compounds gave the best results, formalin did not control *H. avenae*, and fillers such as talc and silica had little fungicidal value, although one sample of silica appeared to exercise some measure of control. Cuprous oxide failed to control the disease and caused a noticeable depression of growth.

WELLHAUSEN (E. J.). **Infection of Maize with Phytomonas flaccumfaciens, P. insidiosa, P. michiganensis, P. campestris, P. panici, and P. striafaciens.**—*Phytopathology*, xxviii, 7, pp. 475–482, 2 figs., 1938.

In inoculation experiments under controlled conditions in the greenhouse with ample moisture and at a temperature range of 80° to 90° F., very young and rapidly growing seedlings of two inbred lines of maize, GB (Golden Bantam) 797 and OSF, were severely injured or killed by pure cultures of *Phytomonas* [*Bacterium*] *flaccumfaciens* [*R.A.M.*, xvii, p. 660], *P. insidiosa* [*Aplanobacter insidiosum*: ibid., xvii, p. 301], and *P. michiganensis* [*A. michiganense*: ibid., xvii, p. 660], while *P.* [*Pseudomonas*] *campestris*, *Phytomonas* [*Bact.*] *panici* [ibid., v, p. 130], and *P.* [*Bact.*] *striafaciens* [ibid., xv, p. 280] induced milder effects. With the exception of *A. insidiosum*, all the organisms attacked line GB 797, susceptible to wilt (*P.* [*A.*] *stewarti*), more readily than the resistant OSF.

The types of symptoms induced by the various organisms were generally similar and included more or less extensive obstruction of the xylem vessels of certain vascular bundles in the leaves, stems, and mesocotyls, and discoloration, frequently accompanied by transparency, of the leaf veins and adjoining tissues.

A. stewarti caused slight dwarfing of Golden Cluster beans [*Phaseolus vulgaris*] and discoloration of the nodal and internodal stem tissues, while Proso millet (*Panicum miliaceum*) and Early Pearl oats inoculated with the same organism developed a brown, water-soaked, irregular striation of the veins resembling that due to wilt on maize. Negative results were obtained in tests with *A. stewarti* on tomatoes and cabbage. The results indicate that the organisms similar to *A. stewarti* in cultural characters (viz., *Bact. flaccumfaciens*, *A. insidiosum*, *A. michiganense*) are capable of considerable growth in the medium of the maize plant under conditions most favourable to *A. stewarti*.

Smith (A. L.), Hoppe (P. E.), & Holbert (J. R.). **Development of a differential inoculation technique for Diplodia stalk rot of Corn.**—*Phytopathology*, xxviii, 7, pp. 497–504, 3 figs., 1 graph, 1938.

The writers have evolved a rapid and convenient inoculation technique for the determination of the relative resistance of inbred lines of maize to stalk rot (*Diplodia zeae*) [*R.A.M.*, xvii, p. 670] in Illinois. In 1931 needle puncture inoculations with pycnospore suspensions of a pure culture of the fungus were made through the lower internodes of 13 single crosses representing various combinations among nine different inbred lines, and measurements of the spread of infection in the pith and cortex were taken during the second week in October. Additional replications of uninoculated plants were kept under observation for their reaction to natural infection by the fungus and the extent of stalk-breaking caused by the disease. The following correlation coefficients were obtained: pith and cortical spread, +0·948; natural infection and broken stalks, +0·909; pith spread and natural infection, +0·853; pith spread and broken stalks, +0·821; cortical spread and natural infection, +0·878; and cortical spread and broken stalks, +0·899.

Evidence was secured in these tests of the positive influence of inbreds on hybrid reaction. Thus, the four different hybrids having the inbred resistant *Hy* as one of the parents ranked highest in resistance to cortical spread, whereas two that combined two susceptible inbreds showed the lowest resistance. Resistance was manifested by one hybrid involving a highly resistant and a very susceptible inbred ($H \times Hy$), indicating a dominance of resistance in this cross.

Bitancourt (A. A.). **A mancha d'agua e a podridão d'agua da Laranja.** [The water spot and water rot of the Orange.]—*Biologico*, iv, 8, pp. 273–274, 1 fig., 1938.

The author records the occurrence in Brazil of a fruit spot, externally identical with the California water spot [*R.A.M.*, xvii, p. 671], on Bahia oranges sent in for examination in 1936 and 1938. The disease probably originated in the groves, although it was first noticed in the stored fruits.

Morris (A. A.). **The effect of differential fertilizer treatments on the yield and quality of fruit from mature bearing Valencia late trees on Mazoe Citrus Estate, Southern Rhodesia.**—*Rep. Brit. S. Afr. Co., Mazoe Citrus exp. Sta., 1936*, pp. 107–154, 3 pl., 2 graphs, 1937. [Received October, 1938.]

Further study in Southern Rhodesia on 'hard fruit' of orange due to

boron deficiency [*R.A.M.*, xvii, p. 744] indicated that the most susceptible variety locally is Valencia Late budded to the Mazoe rough lemon, while the least susceptible appears to be Washington Navel on the same stock.

The first symptom of boron deficiency in the field is a tendency of apparently healthy trees to wilt more frequently than is warranted by the amount of water supplied, this characteristic finally becoming so marked that no amount of water, however frequently applied, prevents wilting even in trees carrying negligible crops. Before this stage is reached, abnormal shedding of the crop occurs. The fruits that remain on the tree show gumming and arrested development. The rind thickens, and the seeds are shrivelled or absent. In the earliest stages the young fruits readily fall, and offer slight resistance to cutting. The fruits are misshapen or mummified, and gradually turn yellowish-green. Gumming may occur anywhere within the fruit, though greatest in the centre towards the end of the season, most of the fruits affected in the rind tissues falling earlier.

New tree growth is limited, and usually short-stemmed. Die-back becomes increasingly marked with the development of multiple bud and short, upright growth. The leaves sometimes become thickened, and in an advanced stage may show characteristic pitting on the under surface, this pitting occurring more usually, but not exclusively, on the leaves most remote from the source of nutrient supply. The final appearance of the affected trees bears a striking resemblance to the published descriptions of exanthema [ibid., xvii, p. 16].

The effect on affected trees of boron applications is one of marked stimulation. All new growth is entirely devoid of pitting. Young fruits are held firmly to the tree and remain turgid. Ripening fruits are very thin-skinned. There is every evidence that the average juice percentage in the local crops will increase considerably as a result of boron treatment.

Marchionatto (J. B.). **Argentine Republic: transmission of the 'lepra explosiva' of the Orange by mites.**—*Int. Bull. Pl. Prot.*, xii, 6, pp. 121–122, 1938.

Positive results are stated to have been obtained in experiments by M. J. Frezzi at the Phytopathological Laboratory, Corrientes Province, Argentine Republic, in the transmission of 'lepra explosiva' [leprosis] from diseased to healthy sweet oranges [*R.A.M.*, xv, p. 14] by means of mites (*Tenuipalpus* sp. near *T. californicus*) (200 to each plant). The symptoms began to develop after $2\frac{1}{2}$ months on the foliage, twigs, petioles, and spines, and as many as 40 lesions were observed on one plant after three months. Severely infected leaves turned yellow and fell.

Reid (W. D.). **Citrus-blast in New Zealand.**—*N.Z.J. Sci. Tech.*, A, xx, 1, pp. 50–54, 4 figs., 1938.

Citrus blast (*Pseudomonas syringae*) [*R.A.M.*, xvii, p. 660], first recognized in New Zealand in 1927, is stated to be now present in the main citrus-growing areas of the Colony. A technical description of the causal organism is given, supplemented by brief notes on the sympto-

matology and control of the disease. Under New Zealand conditions infection is most active during the late winter and early spring, and is frequently serious on nursery stocks, some or all of the laterals of which may be blackened and killed, while the succulent shoots of older trees may be destroyed and the fruits severely pitted. Lemon foliage and fruit are more commonly affected than those of orange. Contributory factors in the development of blast in New Zealand, as elsewhere, include cold, damp conditions and the presence on the immature growth of the host of injuries due to strong winds, driving rain, hail, frost, thorn scratches, or insect infestation.

Reid (W. D.). **Citrus-canker in New Zealand.**—*N.Z.J. Sci. Tech.*, A, xx, 1, pp. 55–62, 5 figs., 1938.

Lemon leaves from Kerikeri, Bay of Islands, submitted for inspection in May, 1937, were found to be infected by citrus canker, the causal organism of which was isolated in pure culture on beef-peptone agar and found to agree with *Pseudomonas citri* [*R.A.M.*, xii, p. 376; xvi, p. 329], a technical description being given. This is the first record of the pathogen in New Zealand. A survey of the North Island revealed the presence of the disease on 698 trees in 33 orchards; in the single affected nursery 28,000 stocks (not all attacked) were destroyed. It has not been possible to trace the source of introduction of the bacterium which apparently entered the country about three seasons ago, possibly less, judging by the condition of the infected tissues. The damage sustained by the affected trees was relatively slight, involving only slight defoliation besides disfigurement of the fruit. At Kerikeri infection occurred roughly in the following descending order of susceptibility: Ponderosa, Eureka, Lisbon, and Meyer lemons, Marsh's Seedless grapefruit, Washington Navel, Valencia, and other sweet oranges; and New Zealand grapefruit or Poorman orange (pomelo × sour orange). Drastic control measures, including 'bare-pole' pruning, stringent sanitary precautions, spraying with lime-sulphur (0·2 per cent. polysulphides), and the application to wounds of bitumen paint or petrolatum have been initiated.

Mayne (W. W.). **Annual Report of the Coffee Scientific Officer, 1937–1938.**—*Bull. Mysore Coffee Exp. Sta.* 17, 17 pp., 1938.

Tests carried out in Mysore with two copper oxide sprays ('materials A and B') against coffee leaf disease (*Hemileia vastatrix*) [*R.A.M.*, xvii, pp. 31, 315] showed that both, especially B, gave promising results. Observations on the time of spraying in hot weather in relation to the blossom showers supported those made in the previous year; in 1936, the plot sprayed earliest gave the best results [ibid., xvii, p. 31], while in 1937 the second plot gave the best figures, with 63 per cent. leaf survival, and 37·4 per cent. infection of the surviving leaves. In both years, the most striking feature was the marked falling-off in the results given by the later applications.

Black bean [loc. cit.] and similar defects caused serious loss, and the evidence obtained again indicated that the cause of these troubles must be sought for much earlier in the crop season than harvest time.

The following defects appear to be fundamentally related, all showing microscopic abnormalities in the silver skin: (1) black 'jelloo', (2) spotted bean, (3) black bean, (4) 'burnt' bean, (5) green bean, and (6) (?) dry and coated bean. All the evidence suggests that these defects are due to some disturbance of the moisture or nutrient supply of the bean comparatively late in its development. 'Burnt' and 'green' beans showed losses of weight on drying which varied between 53 and 60 per cent., as against 49 per cent. for normal beans.

Brown (H. B.). **Cotton: history, species, varieties, morphology, breeding, culture, diseases, marketing, and uses. Second edition.**—xiii+592 pp., 109 figs., 7 diags., 19 graphs, 5 maps, London, McGraw-Hill Publishing Company, Ltd., 1938. 30*s*.

In the revised edition of this valuable treatise on the cotton plant, first published in 1927 and now amplified and brought up to date, the author includes a concise discussion of the chief diseases of the crop in a chapter of 32 pages.

Oknina (Mme E. Z.). Вертициллоз Хлопчатника. [The *Verticillium* disease of Cotton.]—*Тр. Инст. Физиол. Раст. им. К. А. Тимирязева.* [*Trans. Timiryazeff Inst. Pl. Physiol.*], ii, 1, pp. 83–115, 7 figs., 1937. [Received September, 1938.]

Although *Verticillium albo-atrum* [*R.A.M.*, xvi, p. 808] has not been recorded during recent years as an agent of cotton wilt in the U.S.S.R. [but see ibid., xi, p. 41], the author found both this species and *V. dahliae* [ibid., xvii, p. 392] in the diseased tissue of cotton plants in Fergana [Uzbekistan, Asiatic Russia]. The two fungi proved to be clearly distinct in most of their morphological and physiological characters [ibid., x, p. 758]. In quantitative experiments on the growth of the two species on various media, the quantity of medium capable of yielding 100 mg. dry weight of *V. albo-atrum* is taken to be the unit and the corresponding weights of *V. dahliae* produced on units of various media tested were found to be 31·4 mg. on glucose, 48·7 mg. on maltose, 112·6 mg. on starch, 133·5 mg. on sodium nitrate, 148·8 mg. on ammonium nitrate, 133·7 mg. on casein, 22·9 mg. on peptone, and 22·4 mg. on gelatine. Assuming that the fermentative activity of *V. albo-atrum* is 100 for each of a number of endo- and ectoenzymes, the corresponding values for *V. dahliae* were 50 and 30·9 for catalase, 109·4 and 16·4 for amylase, 59·6 and 45·0 for saccharase, and 102·9 and 94·5 for maltase. The rate of transpiration of healthy leaves was found to be generally about 50 per cent. higher than that of the diseased plants (affected by either species) both in the flowering and vegetative phases. The proportion of open stomata was also higher in the healthy plants, and the water content was about twice as high as in the diseased leaves. On the whole *V. albo-atrum* is considered to be the more virulent parasite of the two. No toxic substances capable of causing wilt could be detected either in pure cultures of the fungi or in the diseased tissues, and the biochemical causes of wilt are believed to be inherent in the fermentative action of the parasites.

Sukhorukoff (K. T.). Изучение признаков устойчивости сортов хлопчатника к вилту и гоммозу. [A study of the characters indicating resistance of Cotton varieties to wilt and gummosis.]—*Тр. Инст. Физиол. Раст. им. К. А. Тимирязева.*—[*Trans. Timiryazeff Inst. Pl. Physiol.*], ii, 1, pp. 117–137, 1937. [Received September, 1938.]

This study on wilt and gummosis of cotton, economically the two most important diseases of the crop in Ferghana [Uzbekistan, Asiatic Russia], was carried out by a team of workers sent from the Institute of Plant Physiology of the U.S.S.R. Academy of Science in 1936. Isolations from wilt-diseased tissues yielded an undetermined species of *Verticillum* with strongly pigmented and rapidly growing mycelium, distinct from *V. dahliae*, which was also found, but more rarely [cf. preceding abstract]. In a series of experiments on the physiology of wilt-diseased plants it was found that the accumulation of dry substance in diseased plants is considerably diminished, the transpiration lowered, and the number of open stomata reduced. An anatomical study of various cotton varieties showed that immune varieties have a firm pith of small cells and medullary rays of many layers always filled with reserve starch, whereas susceptible varieties have a loose-textured pith and inconspicuous medullary rays of one or rarely two to three layers with little starch. Selection based on these anatomical distinctions is recommended for breeding work.

Gummosis [blackarm] of cotton caused by *Bacterium malvacearum* [*R.A.M.*, xvii, pp. 391, 439] is generally less important than wilt in the dry climate of Ferghana, except in the nurseries and in damp districts. It was thought that the bacteria multiply in the water collected on the surface of the leaves, thriving on the organic matter diffused into the water. To check this hypothesis fresh and uninjured leaves were immersed in distilled water at 30° C. After 20 minutes some of the water was poured into a flask and the amount of organic matter present was determined by means of potassium permanganate. The results of several replications and variations of this experiment showed that the susceptible varieties diffused more organic matter into the water than the resistant. The diffusion from young leaves of susceptible varieties was higher than from old and increased with the increase of temperature, while both factors were without effect in resistant varieties. Rapidity of ageing of the leaf tissues and consequent reduction in diffusion of organic matter may possibly be a factor in determining resistance.

Feytaud (J.). **Recherches sur le Doryphore : III. Causes de reductions naturelles (milieu, maladies, ennemis).** [Researches on the Colorado Beetle: III. Causes of natural reduction (environment, diseases, pests).]—*Ann. Epiphyt.*, N.S., iii, 1, pp. 35–97, 2 pl., 4 figs., 1937. [Received October, 1938.]

Studies on the possibilities of biological control of the Colorado beetle (*Leptinotarsa decemlineata*) in France by means of its fungal pathogens led to the following conclusions. In the mellow soils of the Bordeaux district the insect is decimated by *Beauveria effusa* [*R.A.M.*,

xvi, p. 531], but immune from infestation by *B. densa*, and highly resistant to *B. globulifera* [loc. cit.] and *B. bassiana* [ibid., xvii, p. 745]. In the vicinity of Rennes, the place of *B. effusa* is taken by another closely related virulent pathogen of *L. decemlineata*, *B. doryphorae* [ibid., xvi, p. 531]. In the United States the Colorado beetle is subject to a disease caused by *Bacillus leptinotarsae*, and there is reason to believe that a bacterium is also pathogenic to the insect in France, but so far circumstances have prevented intensive studies in this direction.

CIFERRI (R.) & REDAELLI (P.). **A new hypothesis on the nature of Blastocystis.**—*Mycopathologia*, i, 1, pp. 3–6, 1938.

The work described in this paper has already been noticed from another source [*R.A.M.*, xv, p. 94].

LODDER (J.) & DE VRIES (N. F.). **Some notes on Torulopsis glabrata (Anderson) nov. comb.**—*Mycopathologia*, i, 2, pp. 98–103, 2 figs., 1938.

The authors describe the results of a morphological and cultural study of five strains of *Cryptococcus glabratus* [*R.A.M.*, xv, p. 153; xvii, p. 177] received at the Centraalbureau voor Schimmelcultures, namely: (*a*) a strain received in 1936 from the American Type Culture Collection, and believed to be almost certainly the authentic strain isolated by Anderson; (*b*) a strain sent by Ota in 1924 from Brussels; (*c*) a strain received in 1934 from the Dermatological Department of the University of Amsterdam, and isolated from a recidivating human ulcer; (*d*) a strain isolated in Holland from the urine of a patient suffering from cystitis; and (*e*) a strain repeatedly isolated in 1937 from the sputum of a Dutch patient presenting symptoms of tuberculosis. The results showed that the organism which, in accordance with the nomenclature adopted by the authors [ibid., xvii, p. 675], is renamed *Torulopsis glabrata* n.comb., did not produce pseudomycelium or ascospores. In malt extract it forms ovoid cells, 4 to 5 by 2·5 to 3·5 μ in diameter, arranged in pairs or in short chains, and on malt agar, besides cells of this type, very small cells, 2·5 to 3 by 1·5 to 2 μ, produced singly or in pairs. Of the sugars tested, only glucose, fructose, and mannose are fermented; and ammonium sulphate, urea, asparagin, and peptone are assimilated but not nitrate. In a medium with ethyl alcohol as the only source of carbon, no growth occurred.

The results of inoculation experiments carried out on rats were inconclusive, but the authors' observations as a whole leave no doubt that *T. glabrata* is a saprophyte of frequent occurrence in man, which under certain conditions may invade the host and give rise to more or less serious local disturbances in various organs.

CIFERRI (R.), REDAELLI (P.), & VISOCCHI (V.). **The Histoplasmaceae family. Synthetic review.**—*Mycopathologia*, i, 2, pp. 104–114, 1938.

The authors discuss at some length their transference of *Posadasia capsulata*, *Cryptococcus farcinimosus*, and *C. muris* to the genus *Histoplasma*, under the names *H. capsulatum*, *H. farcinimosum*, and *H. muris* [*R.A.M.*, xiii, p. 769; xiv, pp. 235, 446, 583], and give full data

from their studies and from the literature in support of this transference. An English technical description of the genus is given.

CIFERRI (R.), REDAELLI (P.), & CAVALLERO (C.). **L'Oidium albicans Robin (Mycotorula albicans (Robin) Lang. et Tal. 1932; studio critico e sperimentale.)** [*Oidium albicans* Robin (*Mycotorula albicans* (Robin) Lang. & Tal. 1932; a critical and experimental study).]—*Mycopathologia*, i, 2, pp. 115–161, 2 pl., 1938. [Summaries in English, German, and Spanish.]

From a careful review of the relevant literature and their studies of a number of isolations received from various parts of the world, the authors find that the organism most frequently isolated from human thrush and capable of causing a great diversity of superficial and deep-seated infections in man and animals is a fungus referred by other workers to *O. albicans* and to several other binomials. It presents the morphological characters of the genus *Mycotorula*, and that it ferments glucose, levulose, and maltose regularly; other carbohydrates irregularly and only to a small extent, and saccharose never. For these and other reasons, which are discussed at some length, they accept Langeron and Talice's combination *M. albicans* [*R.A.M.*, xi, pp. 457, 476], and give a list of 45 binomials which they consider to be certainly synonymous, including *Candida albicans*, *C. bronchialis*, *C. pinoyi*, *Cryptococcus harteri*, *Monilia parakrusei*, *M. psilosis*, *M. metalondinensis*, *M. londinensis*, *M. richmondi*, and *Myceloblastanon favrei*. A list is also given of nine doubtful synonyms, including *Monilia inexorabilis* [ibid., xv, p. 581]. An Italian technical description of the yeast is appended.

LEWIS (G. M.) & HOPPER (MARY E.). **Infections of the skin due to Monilia albicans. II. Immunologic, etiologic, and therapeutic considerations.**—*N.Y. St. J. Med.*, xxxviii, 11, pp. 859–866, 2 figs., 2 graphs, 1938.

In the course of studies on various forms of dermatomycosis associated with the presence of *Monilia* [*Candida*] *albicans* [*R.A.M.*, xvii, p. 746 and preceding abstract] on the skin or tongue or in the intestinal tract, the writers detected the fungus in one or more of these sites in 52 New York hospital patients from 10 to 69 years old. Some evidence was obtained of its connexion with excess weight, diabetes [see next abstract], and previous debilitating illness, while a specially high degree of susceptibility was observed among persons whose occupations necessitated frequent soaking of the hands.

KELLY (H. T.). **The significance of dermatophytosis in diabetes.**—*Penn. med. J.*, xli, 7, pp. 581–589, 5 figs., 1938.

The very important part played by species of *Epidermophyton* in the preparation of the cutaneous tissues for secondary infection by gangrene in diabetic patients is reviewed and preventive and therapeutic measures discussed. Excellent diagnostic and curative results have been obtained with Fonseca's 'dermotricofitin' vaccine, consisting of a filtrate of 300 strains of *Trichophyton*, *Microsporon*, *Achorion*, *Endodermophyton*, and *Epidermophyton*.

NIIZAWA (S.). **Ueber die Dermatomykosen in unserer Klinik, in Laioyang, Tienring und in einigen japanischen Militärregimentern.** [On the dermatomycoses observed in our clinic, in Liaoyang, Tienring, and in certain Japanese military regiments.]—*J. orient. Med.*, xxviii, 6, pp. 1275–1308, 2 pl., 4 figs., 9 graphs, 1938. [Japanese, with German summary on pp. 100–101.]

During the period from April, 1934 to May, 1935, the writer isolated from 235 cases of dermatomycosis in his clinic at Mukden, Manchukuo, in Liaoyang, Tienring, and in certain Japanese regiments, 165 fungal strains belonging to the species *Trichophyton violaceum*, *T. glabrum*, *T. purpureum* [*R.A.M.*, xvii, p. 679], *T. interdigitale*, *T. gypseum radiolatum* [? *T. mentagrophytes*], *T. pedis* [ibid., xvi, p. 459], *Epidermophyton inguinale* [*E. floccosum*: ibid., xvii, p. 747], *Endodermophyton* [*T.*] *concentricum* [ibid., xvii, p. 245], *Microsporon japonicum* [ibid., xvi, p. 748], and *Grubyella* [*Achorion*] *schönleini* var. *mongolica* [loc. cit.]. Of these, *T. interdigitale* and *T. purpureum* were found to be the chief agents of trichophytia pompholiciformis (54 cases) and trichophytia interdigitalis (65), respectively, four patients suffering from these disorders harbouring both species simultaneously.

MILOCHEVITCH (S.). **Trichophyton immergens et ses manifestations cliniques.** [*Trichophyton immergens* and its clinical manifestations.] —*Mycopathologia*, i, 2, pp. 88–97, 3 pl., 1938.

Trichophyton immergens [*R.A.M.*, xvi, p. 457] was isolated from eleven cases of circinate herpes in Jugoslavia, and also from ringworm on an ox. The fungus is apparently present in nearly the whole of the country, with the exception of the most westerly provinces, and it is believed that human beings very probably contract infection from cattle, although it may also be transmitted from man to man. In pure culture *T. immergens* was shown to differ from other megaspore-producing *T.* species [which are listed in a comparative table] by its colonies on glucose media being almost completely immersed, while on maltose substrata they exhibit a ring of white down and a halo of short rays of equal length around an irregular centre.

GRIGORAKI (L.). **Sur un nouveau milieu de conservation des dermatophytes.** [On a new medium for the preservation of dermatophytes.]—*C.R. Soc. Biol., Paris*, cxxviii, 22, pp. 887–888, 1938.

The following formula is stated to have given excellent results in the prevention of pleomorphism [cf. *R.A.M.*, xvi, p. 383] in *Trichophyton faviforme* (14 strains from the U.S.S.R.) [ibid., xvi, p. 535], *Achorion violaceum* [ibid., xvii, p. 395] (3 from Greece), and one each of *Microsporon lanosum* and *T. crateriforme* [ibid., xvii, p. 680]: 1·8 gm. agar, 1 gm. peptone, 2 gm. maltose, and 50 c.c. each of water and milk.

GRIGORAKI (L.) & DAVID (R.). **Caractères biochimiques des champignons des teignes.** [The biochemical characters of the ringworm fungi.]—*C.R. Soc. Biol., Paris*, cxxviii, 22, pp. 889–891, 1938.

The writers briefly describe and tabulate the results of their comparative biochemical studies on *Trichophyton crateriforme* and *Achorion*

violaceum [see preceding abstract], agents of human ringworm in Greece, cultured on Sabouraud's medium. The dissolution of the casein content of 10 c.c. of milk was accomplished in 19 days by *T. crateriforme* and in 40 by *A. violaceum*, the corresponding periods for the liquefaction of gelatine being 6 and 3 days, respectively. The reducing sugar in a 10 per cent. saccharose solution amounted to 2·05 gm. per l. in the case of *T. crateriforme* and to 2·60 in that of *A. violaceum*. *T. crateriforme* fermented glucose in an 8 per cent. solution, but *A. violaceum* was unable to do so. Both species grew best at 35° C., the maximum for *T. crateriforme* being 45° and for *A. violaceum* 43°

GOHAR (N.). **The first survey of ringworm in Egypt.**—*J. trop. Med. (Hyg.)*, xli, 14, pp. 229–234, 3 graphs, 1938.

An analysis of 300 cases of ringworm infection in Egypt is presented, based on the microscopic examination of isolations of the fungi concerned on Sabouraud's glucose agar. Favus associated with *Achorion schoenleini* [*R.A.M.*, xvii, p. 530] was the predominant disorder, occurring in 58·67 per cent. of the total number of cases investigated, followed by *Trichophyton violaceum* [ibid., xvii, p. 679] (39·67), *Microsporon canis* [ibid., xiv, p. 581; xvii, p. 174] (1·33), and *T. tonsurans* [ibid., xiv, p. 169] (0·5). *A. schoenleini* was most prevalent in the country (83 per cent. of all cases) and *T. violaceum* in the town (52·6). Boys are more liable to infection than girls, especially by *A. schoenleini* (60·3 and 56·2 per cent., respectively). Favus infections tend to assume a chronic character, while those due to *T. violaceum* run comparatively shorter courses. The clinical features and microscopical data of the four types of infection are described.

GOMES (J. M.). **Chromoblastomycosis caused by a fungus of the genus Hormodendron.**—*Arch. Derm. Syph., Chicago*, xxxviii, 1, pp. 12–18, 4 figs., 1938.

A hitherto undescribed species of *Hormodendrum*, forming greyish-green colonies on Sabouraud's medium, was isolated at São Paulo, Brazil, from an injury on the hand of a workman inflicted by the fall of a small *Eucalyptus* branch. The fungus formed concatenate, unicellular, oval, or rounded, acrogenous spores and round pigmented bodies (6 μ in diameter in culture, 3 to 4 μ in the tissues). Positive results were obtained in inoculation experiments on laboratory animals. The fungus is not named.

CATANEI (A.). **Sur la place de Trichophyton rubrum dans la classification. Étude parasitologique et expérimentale d'une nouvelle souche de ce champignon.** [On the systematic position of *Trichophyton rubrum*. A parasitological and experimental study of a new strain of this fungus.]—*Arch. Inst. Pasteur Algér.*, xvi, 2, pp. 227–231, 1 pl., 1938.

On Sabouraud's glucose agar a strain of *Trichophyton rubrum* isolated from the inguinal region of a 17-year-old native of Tongking [Indo-China: *R.A.M.*, xvii, p. 679] formed velvety, plicate, darkish-red colonies with a downy, white centre and smooth, yellowish-white

periphery. The reddish pigmentation did not develop on malt or non-sugar-containing agars and was generally missing also from rice flour agar; the last-named medium proved particularly valuable for the study of the spores of the fungus [cf. ibid., xvi, p. 457]. Inoculation experiments on guinea-pigs and monkeys with pure cultures of this strain of *T. rubrum* induced the development of the megaspore ectothrix type of hair infection. Langeron and Milochevitch [ibid., x, p. 242] place *T. rubrum* among the species not attacking the hair, and its transference to the second (megaspore) section of their classification is suggested.

CIFERRI (R.) & VERONA (O.). **A species of Sporobolomyces (Nectaromycetaceae) isolated from man and a revision of the genus.**—*Mycopathologia*, i, 2, pp. 162–164, 1938.

Among the new species described in this revision of the genus *Sporobolomyces*, mention may be made of *S. pollaccii* n.sp., which was isolated from a human dermatomycosis at Siena, Italy; its pathogenicity has not yet been determined. [An expanded account of this work is published in *Atti Ist. bot. Univ. Pavia*, x, Ser. IV, pp. 240–255, 1938.]

LACK (A. R.). **Spherule formation and endosporulation of the fungus Coccidioides in vitro.**—*Proc. Soc. exp. Biol., N.Y.*, xxxviii, 5, pp. 907–909, 1938.

Details are given of a series of semi-anaerobic experiments undertaken at Stanford University School of Medicine, San Francisco, with a view to determining the prerequisite conditions for spherule formation in *Coccidioides immitis* [*R.A.M.*, xvi, p. 461; xvii, p. 528].

Constricted tubes of the Hall type (*J. infect. Dis.*, xxix, p. 317, 1921) were filled above the point of constriction with glucose broth (P_H 7·2) and heated to 100° C. for 15 minutes. After cooling to room temperature they were inoculated with a suspension of chlamydospores in a preparation of fresh egg albumin from an eight-week-old culture; this was pipetted into the bottoms of the tubes, the constricted necks of which were closed off by sterile marbles. Partial coagulation of the albumin was obtained by gentle warming. Four control tubes were prepared: one identical with the foregoing but uncoagulated, one containing the inoculum but no marble, one with albumin alone, and one with the chlamydospore suspension and no albumin.

After 24 hours the chlamydospores within the albumin showed slight enlargement, and at the end of 48 hours incipient spherule formation was detected. Some of these bodies measured 20 to 30 μ in diameter and were characterized by a finely granular content and greenish, granular capsules (granular type), while others, 30 to 40 μ in diameter, also of a granular consistency, possessed a thick, yellow-green capsule, from the periphery of which radiated numerous large spicules, broad at the base and narrowing to a very sharp point, as described by Rixford and Gilchrist (*Rep. Johns Hopkins Hosp.*, i, p. 209, 1896). After a week many greenish, granular spherules, some with typical spicules, were revealed by cover-slip examinations of the egg albumin in the experimental tubes, while a few clear spherules with wide, refractile, double-contoured, yellowish-green capsules were also present, together with one large spherule (50 μ in diameter)

containing endospores, 6 to 10 μ in diameter. The control tubes showed no spherule development; mycelial growth occurred in the one with no marble and in that inoculated with the fungus alone.

Rackemann (F. M.), Randolph (T. G.), & Guba (E. F.). **The specificity of fungous allergy.**—*J. Allergy*, ix, 5, pp. 447–453, 2 diags., 1938.

The specificity of extracts of *Cladosporium fulvum* was strikingly demonstrated by intradermal tests on four patients contracting asthma when exposed to spores of the mould in a commercial greenhouse [*R.A.M.*, xvi, p. 676]. All reacted strongly to the leaf mould fungus but showed little or no response to other species of *Cladosporium*. Passive transfer of the skin test to normal persons was effected in all four cases. The bearing of these observations on the study of fungal allergy [ibid., xvii, p. 599] is discussed.

Martin (D. S.). **The antigenic similarity of a fungus Cadophora americana isolated from wood pulp to Phialophora verrucosa isolated from patients with dermatitis verrucosa (chromoblastomycosis).**—*Amer. J. trop. Med.*, xviii, 4, pp. 421–426, 1938.

Cadophora americana, isolated from wood pulp and morphologically very similar to *Phialophora verrucosa* [*R.A.M.*, xvii, p. 178], associated with human chromoblastomycosis, was found to be equally closely related antigenically to the pathogen of man, whereas five other *C.* spp. from wood pulp morphologically distinct from *P. verrucosa*, viz., *C.* [*P.*] *lagerbergii*, *C.* [*P.*] *brunnescens*, C. [*P.*] *melinii*, *C.* [*P.*] *fastigiata*, and *C.* [*P.*] *repens*, differed likewise in their complement fixation reactions. The latter are thus of definite value in supplementing morphological criteria for the differentiation of human pathogens and those isolated from natural sources.

Lyle (E. W.). **The black-spot disease of Roses, and its control under greenhouse conditions.**—*Bull. Cornell agric. Exp. Sta.* 690, 31 pp., 2 figs., 1938.

A full description is given of studies conducted at Cornell on rose black spot (*Diplocarpon rosae*) [*R.A.M.*, xvii, p. 682], and its control, already noticed in part from another source [ibid., xv, p. 722]. The results obtained [which are tabulated and discussed] showed that in greenhouses the organism is either being carried over from one season to the next on leaves left on the plants during pruning, or introduced into the houses on infected plants during replanting. Besides the leaves, the sepals, receptacles, flower stems, and canes may be attacked and premature defoliation may reduce the number of leaves by as much as 20 per cent. Under favourable conditions all varieties of greenhouse roses are affected, though some, including Double White Killarney, Talisman, Mrs Franklin D. Roosevelt, and Souvenir are less susceptible than others.

Data obtained from outdoor roses showed an average of 32,000 conidia per leaf spot, the latter averaging 6·3 mm. in diameter. Tests of the possibility of dissemination by air currents gave negative results and dissemination is evidently accomplished mainly by splashing water

[loc. cit.]. The optimum temperature for germination was found to be about 26° C., the minimum about 15°, and the maximum approximately 33°. Spores did not germinate unless wetted with water, but if wetted for only a brief period they then germinated readily in 100 per cent. relative humidity, and germination occurred (15 per cent.) even after the wetted spores were dried for 48 hours. In the greenhouse, lesions became visible within five to ten days of initial infection and acervuli matured a day or two later. The under side of the rose leaf was somewhat more susceptible to infection than the upper.

Detailed information is given on control experiments. Effective control resulted from withholding syringing, and spraying against red spider [*Tetranychus telarius*] with selocide (1 in 300) plus new evergreen spreader (a pyrethrum-oil soap product) at 1 in 1,000. In the first five tests (with no unsprayed areas as controls) this gave from 95·7 per cent. reduction of black spot in 76 days (Rapture variety) to 99·9 per cent. reduction in 130 days (Sweet Adeline variety), while in a further three tests (control areas syringed but not sprayed) it gave 66·9 per cent. reduction on the Premier Supreme variety in 33 days and 92·3 per cent. reduction in 94 days, 86·3 per cent. reduction on Rapture roses in 72 days, and 99·8 per cent. reduction on Pernet in 140 days. The cost of labour and material for spraying was not more than twice that of syringing.

To avoid plant injury from the combination of selocide with vaporized sulphur about a week should elapse between using selocide at concentrations of 1 in 300 or higher and volatilizing sulphur from the pipes, and vice versa. Dusting sulphur may be used safely instead of vaporized sulphur for the control of rose mildew [*Sphaerotheca pannosa*], if this develops while selocide spraying is in progress.

GOTO (K.). **Anthracnose of Digitalis caused by Colletotrichum fuscum Laubert.**—*Ann. phytopath. Soc. Japan*, viii, 1, pp. 1–8, 4 figs., 1938. [Japanese, with English summary.]

Digitalis purpurea leaves affected by anthracnose in Japan bear purplish-brown, circular or bluntly angular spots, averaging 1 but up to 3 or 4 mm. in diameter, scattered over the surface, while small, fusiform, sunken, blackish-brown lesions are formed on the large veins and petioles. Black, pulvinate or disciform, often confluent acervuli, 24 to 120 μ in diameter, are produced on the light brown centres of old lesions, and hyaline, rod-shaped conidiophores arise from the pseudoparenchyma, tapering towards the apex and of about equal length with the hyaline, continuous, long-elliptical to cylindrical, straight or slightly curved conidia, 12 to 21 by 3·5 to 4·5 μ. Dark brown, straight or flexuous, 3- to 5-septate setae, 75 to 120 μ in length, 4·5 to 7 μ in basal width, tapering and becoming hyaline towards the apex, are produced in profusion. Good growth is made on agar media, one strain of the causal organism producing acervuli with setae and conidia, while others give rise only to an olivaceous mycelium. Inoculation tests resulted in the infection of uninjured leaf blades and petioles and damping-off of seedlings.

The following anthracnose fungi have previously been recorded on *D. purpurea*, namely, *Gloeosporium digitalis* E. Rostr., *Colletotrichum*

fuscum Laubert (*Gartenwelt*, xxxi, p. 674, 1927), *C. digitalis* (E. Rostr.) Moesz [*R.A.M.*, xi, p. 328], and *C. digitalis* Unamuno [ibid., xiii, p. 596]. The Japanese fungus approximates most closely to *C. fuscum*, with which it is accordingly identified. The fungus studied by Moesz is also probably only a form of the same species and Unamuno's species is probably a synonym. *G. digitalis*, forming large, dark brown spots, with its smaller conidia (8 to 10 by 3 to 4 μ) and absence of setae, is regarded as distinct.

Boughey (A. S.). **Honey fungus as a disease of Rhododendron.**—*Gdnrs' Chron.*, civ, 2692, p. 84, 5 figs., 1938.

A considerable number of *Rhododendron* plants, especially [*R.*] *sanguineum*, but also of [*R.*] *lapponicum* and [*R.*] *saluenense* grown in the Royal Botanic Garden, Edinburgh, on a 'rootery' constructed by half burying old tree stumps, were found to be dead or dying from an attack by *Armillaria mellea* [*R.A.M.*, xii, p. 696], the rhizomorphs of which could be traced back through the soil to some of the stumps, up to a distance of 30 ft. The leaves became yellow, later brown, and fell, and after the mycelium had completely girdled the stems at the base the upper parts of the plants shrivelled and died. The fungus appeared to be able to form a mycelium only in fairly fresh timber and it is, therefore, recommended that stumps to be used for a 'rootery' should be set aside for four or five years. The ground chosen for the 'rootery' should be carefully cleared of all old wood and treated with a soil fungicide.

Buchwald (N. F.). **Riddersporens Pletbakteriose (Phytomonas delphinii).** [Spot bacteriosis of Larkspur (*Phytomonas delphinii*).]—Reprinted from *Gartnertidende, 1938*, 38, 2 pp., 3 figs., 1938.

Black spot of *Delphinium* (*Phytomonas* [*Bacterium*] *delphinii*) [*R.A.M.*, xvi, p. 798] was first observed in Denmark in 1937 on *D. hybridum* and again appeared in 1938 on the Lize, Rosenlust, and Turquise varieties of *D. elatum*. The causal organism was isolated from the brown, necrotic tissues underlying the pitch- to tar-black, diffuse, sometimes confluent lesions on the leaves. In addition to the usual cultural measures the writer recommends the application to the soil of copper-containing washes during the phase of emergence in the spring and repeated treatments with Bordeaux mixture throughout the growing period.

Neergaard (P.). **Phyllosticta aspidistrae. En for Danmark ny Aspidistra-Sygdom.** [*Phyllosticta aspidistrae.* A new *Aspidistra* disease for Denmark.]—Reprinted from *Naturen og Hjemmet, May, 1938*, 1 p., 1 fig., 1938.

Phyllosticta aspidistrae Oudemans, which is characterized by non-septate, elliptical conidia measuring 7·5 by 2·5 μ, was isolated in April, 1938, at the Ohlsen Phytopathological Laboratory, Copenhagen, from the black, raised pycnidia occupying some of the large, irregular, chestnut-brown lesions on the leaves of an indoor plant of *Aspidistra lurida*, this being the first record of the fungus in Denmark. Control

measures should include the removal and destruction of diseased foliage and treatment of the healthy leaves with a standard fungicide.

Klaus (H.). **Stengelfäule an Kalanchoë.** [Stem rot of *Kalanchoë*.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 29, p. 340, 1938.

This is a popular note on the stem rot of *Kalanchoë blossfeldiana* caused by *Phytophthora cactorum* in German nurseries [*R.A.M.*, xvi, p. 537] and its control by appropriate cultural measures (including the sparing use of nitrogenous manures) and spraying with Bordeaux mixture.

Blumer (S.). **Ueber zwei parasitische Pilze auf Zierpflanzen.** [Concerning two parasitic fungi on ornamental plants.]—*Mitt. naturf. Ges. Bern, 1937*, pp. 17–25, 1 pl., 1938.

Impatiens parviflora was attacked at Berne in 1936 by *Puccinia komarowi* Tranzsch., this being the first record of the rust in Switzerland. Inoculation experiments with aecidiospores and uredospores of the rust gave positive results on the original hosts, *I. firmula*, *I. capensis*, *I. balsamina* (very severe infection in the form of circular, pale, later brown lesions bearing uredosori on the under side of the leaves), and *I. scabrida*. The protection of *I. balsamina*, a popular ornamental, necessitates the drastic extermination of *I. parviflora*.

Alyssum saxatile and its vars. *citrinum* and *compactum* (hort.) are extensively infected in the Berne district by a gall-producing *Peronospora* characterized by profusely branched conidiophores 400 to 800 μ in height, ending in curved prongs, 10 to 22 μ in length (average 15 to 17 μ), and ellipsoid or globose conidia, 12 to 22 by 11 to 21 (16 to 19 by 14 to 17 μ). Negative results were obtained in inoculation experiments on other *A.* spp. and a number of crucifers, and the fungus is considered to be a new species, *P. galligena* [with a Latin diagnosis], presenting a highly specialized form of the group species *P. parasitica*.

Tavel (C[atherine] v.). **Die Schusslöcherkrankheit des Löwenmauls, Heteropatella antirrhini.** [The shot hole disease of Snapdragon, *Heteropatella antirrhini*.]—*Mitt. naturf. Ges. Bern, 1937*, p. xx, 1938.

The so-called 'shot hole' disease of the snapdragon [*Antirrhinum majus*] due to *Heteropatella antirrhini* [*R.A.M.*, xvi, p. 278] was observed in the writer's garden at Berne in the summer of 1936, this being apparently the first record for the Continent. The leaves were covered with necrotic spots, which fell out and caused the typical 'shot hole' aspect. Severe damage was further noted in a late summer frame sowing.

Hogetop (C.). **Uma doença fungica do Tremoço.** [A fungal disease of the Lupin.]—*Rev. agron.* [*Brazil*], i, pp. 346–350, 1937. [Abs. in *Zbl. Bakt.*, Abt. 2, xcviii, 25–26, p. 486, 1938.]

White lupins (*Lupinus albus*), the cultivation of which as a green manure has recently been started in Brazil, were severely damaged in 1937 by the brown spot disease due to *Ceratophorum setosum* [*R.A.M.*, xvii, p. 686]. Young plants are frequently killed following

complete defoliation, and a reduction of yield invariably ensues. Infection is spread by means of the conidia, which remain viable for a long time in the soil, or by diseased seed, the former method probably being the more usual. Attempts to combat the fungus by fungicidal treatment having given negative results, cultural measures (probably including quinquennial crop rotation) are tentatively recommended for the control of the disease.

MANN (H. H.). **Investigations on Clover sickness.**—*J. agric. Sci.*, xxviii, 3, pp. 437–455, 1938.

The author states that in his opinion what the English farmer commonly understands by the term 'clover sickness' of a soil is not so much a condition under which clover crops fail to establish themselves or die either generally or in patches, chiefly during the autumn following the sowing (from attacks by a parasitic disease such as *Sclerotinia trifoliorum*), as one in which the soil is incapable of producing a properly sized plant of clover. Such dwarfing may occur in the absence of *S. trifoliorum*. The intensity of the sickness may be measured by the relative size of the clover plant as compared with that produced in a normal, healthy soil of the same kind with similar manuring within a definite period. He then gives details of his investigations, started in 1931, to determine the actual primary cause of the condition, the results of which so far are stated to have been negative. Further work on the problem is in progress.

FISCHER (G. W.). **Some new grass smut records from the Pacific Northwest.**—*Mycologia*, xxx, 4, pp. 385–395, 3 figs., 1938.

Notes are given on seven smuts [including two new species, with Latin diagnoses] which the author records on forage grasses in the Pacific North-west of the United States. *Ustilago hypodytes* [*R.A.M.*, xv, p. 511] was found on *Agropyron pauciflorum*, *A. inerme*, and *A. cristatum*, and *U. bullata* [ibid., xvii, p. 505] on *A. caninum* (artificial infection), *A. inerme*, *Elymus canadensis*, *E. glaucus* (artificial infection), *E. glaucus jepsoni*, and *E. sibiricus*. A smut collected twice from *A. cristatum* and once from *E. glaucus jepsoni* was shown by cross-inoculation experiments to be *U. hordei*, and a smut indistinguishable from *U. tritici*, with which it is provisionally identified, was collected on *A. sibiricum*. *U. striaeformis* was found on *A. pauciflorum*, *A. caninum*, *A. cristatum*, *A. inerme*, and *A. spicatum*, all of which are apparently new host records for this smut. The smut which in 1935 was reported on *Agrostis palustris* by Sprague as *Tilletia decipiens* (Pers.) Körnicke is described as a new species, *T. pallida*.

GOODWIN (W.), PIZER (N. H.), SALMON (E. S.), & WARE (W. M.). **The control of Apple scab: Allington Pippin and Newton Wonder, 1937.**—*J. S.-E. agric. Coll., Wye*, xlii, pp. 37–41, 1938.

In further comparative spraying tests against apple scab [*Venturia inaequalis*: *R.A.M.*, xvi, p. 818] conducted in Kent in 1937, Allington Pippin trees given two pre- and two post-blossom applications of cottonseed oil Bordeaux emulsion (as used in earlier tests) gave, respectively, 21·5 and 16·1 per cent. scabbed apples in two plots

sprayed annually with a fungicide since 1927, while in three control plots in the same orchard given the same treatments in 1937, but no spray treatment from 1927 to 1936, inclusive, the corresponding figures were 32·2, 14·2, and 12·5 per cent.

The same treatments on two plots of Newton Wonder trees which had been sprayed annually with a fungicide since 1927 gave, respectively, 24·3 and 23·3 per cent. scabbed fruits, as against 34·4, 23·1, and 13·2 per cent. in three plots given the same treatments in 1937, but untreated from 1927 until that year.

Muskett (A. E.), Horne (A. S.), & Colhoun (J.). **The effect of manuring upon Apple fruits.**—*Ann. appl. Biol.*, xxv, 1, pp. 50–67, 2 figs., 1938.

The effects of manuring apple trees with nitrogen, potash, and phosphate were investigated in an orchard in Northern Ireland during the years 1929 to 1932, 1930 being the only one with a good crop. Nitrogenous manuring was found to increase the nitrogen content of the fruit (from 0·0229 and 0·0430 per cent. in the control to 0·0550 and 0·0745 per cent. in the treated plots for 1930 and 1931, respectively) and the presence of nitrogen was observed to favour the growth of the tree, to induce earlier flowering, more bloom, greener foliage, and softer and greener fruit. On the other hand it increased the intensity of the attack of *Venturia inaequalis* on the fruit. The percentage weight of scabbed fruit (S) was correlated with the nitrogen content (N) of the fruit and the value of the coefficient was calculated as $r_{SN} = +0{\cdot}8292$. The mean values for the radial advance (in mm. per diem) of *Cytosporina ludibunda* [see above, p. 795] in samples of fruit from plots receiving nitrogenous manures was 0·889 in 1930, 1·08 in 1931, and 0·89 in 1932, while the corresponding figures for plots receiving no nitrogen were 0·153, 0·33, and 0·54. In 1930 the rate of radial advance for the sample from the plot treated with nitrogen only was 1·213 mm., the corresponding figures for the plots treated with nitrogen+potash, nitrogen+potash+phosphate, nitrogen+phosphate, phosphate only, potash only, and phosphate+potash being 1·249, 0·456, 0·678, 0·150, 0·082, and 0·118 mm., respectively.

Dearness (J.) & Foster (W. R.). **Coniosporium disease of Apples and Crab-Apples.**—*Canad. J. Res.*, Sect. C., xvi, 7, pp. 274–276, 4 figs., 1938.

In the spring of 1937 apples and crab-apples growing on Vancouver Island were widely affected by a new leaf disease, which on one crab-apple tree had caused over 75 per cent. defoliation, though on cultivated apples hardly any tree showed as much as 10 per cent. loss of leaves. Small, greyish-brown spots appeared on and spread along the veins and veinlets and generally branched from them in a dendriform manner. They turned nearly black as a layer of spores developed on them, sometimes darkening the entire upper surface of the leaf. As a rule, they were indistinct on the lower surface. On the fruit, the small, scattered acervuli became confluent under the greyish cuticle. This scaled off, with the result that a scab was produced over the shrunken, cracked pulp, very similar to that due to *Venturia inaequalis*. The

fungus, which is named *Coniosporium mali* Dearness & Foster n.sp. [with a Latin diagnosis] is characterized by olivaceous, oblong or slipper-shaped conidia measuring 13 to 20 by 3·3 to 8 (average about 14·9 by 5) μ, apparently sessile, or borne on fertile, brown hyphae measuring 3 to 13 (20) by 3 μ.

The varieties Grimes Golden, McIntosh Red, and Vanderpool Red were severely affected, while Alexander, Bismarck, Duchess, King, Oldenburg, Salome, Wealthy, and Yellow Newton showed less serious injury. It is probable that the disease will respond to the control measures used against *V. inaequalis*.

Lindquist (J. C.). **Muerte de Manzanos ocasionada por Phytophthora cactorum.** [Death of Apples caused by *Phytophthora cactorum*.]—*Rev. Fac. Agron., B. Aires*, xxi (*1936*), pp. 195–199, 1 pl., 2 figs., 1938.

Attention is drawn to the occurrence on Transparent de Croncelles and Patte de Loup apples in La Plata, Argentine Republic, of the trunk and root rot due to *Phytophthora cactorum* [*R.A.M.*, xvii, pp. 399, 584], which was isolated in pure culture on a number of standard media and produced sexual organs in profusion. Inoculation experiments gave inconclusive results owing to the death of both test trees and controls from another cause, but further trials have been initiated.

Fromme (F. D.) & Schneiderhan (F. J.). **Studies on black root of Apple.**—*Phytopathology*, xxviii, 7, pp. 483–490, 2 figs., 1 diag., 1938.

A high incidence of black root rot (*Xylaria mali*) occurred within two to three years on young apple trees [*R.A.M.*, xiv, p. 373] planted in thoroughly infected orchard soils in West Virginia. Of 165 two-year-old trees so exposed to the fungus, 100 (60·6 per cent.) developed from one to ten separate lesions, with extensive root and crown invasion. No evidence of any promising degree of resistance was exhibited by any of the 45 apple clones (including one of *Malus* [*Pyrus*] *zumi*) exposed to natural infection, or by 12 clonal and 11 seedling root stocks inoculated with the fungus in pure culture. In one series of tests, 86 out of 91 trees contracted the root rot.

Kunkel (L. O.). **Contact periods in graft transmission of Peach viruses.**—*Phytopathology*, xxviii, 7, pp. 491–497, 1 fig., 1938.

Periods of 8 to 14 days were found to be necessary for the transmission of peach yellows, little peach [*R.A.M.*, xvii, p. 223], and rosette [ibid., xvi, p. 329] by budding from diseased to healthy trees, except during the early spring, when the minimum times requisite were 3, 5, and 4 days, respectively. The passage of mosaic [ibid., xvii, p. 301] was more rapid (2 to 3 days in April and June inoculations; 3 to 6 in September), possibly on account of the easier establishment of plasmodesmatal connexions between the infected and healthy tissues in this case than in the other disorders under discussion.

Zeller (S. M.). **Septoria brevispora (Sacc.) Zeller renamed.**—*Phytopathology*, xxviii, 7, p. 523, 1938.

The name *Septoria brevispora* having already been used by Ellis

and Davis for a parasite of *Bromus ciliatus* (*Trans. Wisc. Acad. Sci.*, p. 99, 1903), the writer here renames his species on *Rubus* [*R.A.M.*, xvii, p. 190] *S. darrowii* n.nom.

PUGSLEY (A. T.). **Degeneration diseases of the Strawberry. The local problem and a review of the present knowledge of these diseases.**—*J. Dep. Agric. Vict.*, xxxvi, 7, pp. 358–364, 8 figs., 1938.

Strawberry crinkle and yellow edge [*R.A.M.*, xvi, p. 762; xvii, p. 694], though probably present in Victoria for some years, were not identified locally until early in 1936. In November, 1935, Melba strawberries in the Silvan district of Victoria were found to be affected by a disease resembling the American crinkle, but in addition to virus symptoms the plants wilted in the early summer during fruiting. The exact relation of the wilt to crinkle remains to be determined, but it is thought that crinkle-infected plants are unable to withstand the stress imposed on them at the commencement of the hot weather, especially if soil drainage is poor. In some plantings almost every plant was affected by the disease. In March, 1936, the affected plants were found to have produced a new crop of green leaves, but were slightly stunted and generally unthrifty and the young leaves were markedly crinkled. In the following season, the wilt stage was less evident, though in the early summer of 1937 it was again general. Crinkle symptoms were again common, though less marked, during the autumns of 1937 and 1938. The varieties Wilson's Pride and Ettersburg (?89) appeared to be much more resistant than Melba, while Tardive de Léopold, though showing a high percentage of crinkled plants, did not suffer as much loss of vigour as Melba.

In the autumn of 1937, symptoms resembling those of yellow edge appeared in a planting of Royal Sovereign strawberries (a variety not grown commercially in Victoria), though adjacent Melba plants were unaffected. In 1938, the former variety showed both diseases on one and the same plant. *Capitophorus fragariae*, the vector of both crinkle and yellow edge, is stated to be widespread in Victorian plantations.

The paper concludes with brief recommendations for control based on the literature of the subject.

SAKIMURA (K.). **Thysanoptera of Kauai with notes on the incidence of yellow spot on wild host plants.**—Reprinted from *Proc. Hawaii ent. Soc.*, x, 1, 7 pp., 1 map, 1938.

Pineapple yellow spot [*R.A.M.*, xvii, p. 331] was in 1935 reported from Kauai [Hawaiian Islands], where the general source of infection is out-field infected *Emilia sonchifolia*, and *E.* spp. 3 and 4, the abundant, highly susceptible wild hosts of the virus. The vector, *Thrips tabaci*, one of the commonest species of *Thrips* in the Island, showed a preference for the *Emilia* plants.

MARSH (R. W.) **Some applications of laboratory biological tests to the evaluation of fungicides.**—*Ann. appl. Biol.*, xxv, 3, pp. 583–604, 1938.

Details are given of laboratory experiments in which the author tested the toxicity to the spores of *Venturia inaequalis*, *V. pirina*, and

Nectria galligena collected from natural infections in the field, of 21 chemical compounds, including 11 so-called rubber (vulcanizing) accelerators, lauryl and cetyl thiocyanates, thiodiphenylamine, and seven copper compounds, both by Montgomery and Moore's methods on glass slides [*R.A.M.*, xvii, p. 405] and by the author's technique on the surface of apple and pear leaves [ibid., xvi, p. 331]. In a parallel series of experiments the effect of eight spray supplements, namely, sulphonated lorol, agral 2, methyl cellulose, sulphite lye, gelatine, lime casein, petroleum oil emulsion, and cottonseed oil on the tenacity of the sprays was determined.

The results showed that the rubber accelerators and other organic sulphur derivates which were found to be most toxic in the tests on slides, gave no promise in leaf tests of being useful in the field. In the laboratory tests with spray supplements, sulphite lye and oils emulsified with sulphite lye were shown to diminish the tenacity of the sprays, as reflected in the high percentage germination of spores for the leached slides. A slightly deleterious effect on tenacity was shown by methyl cellulose but none by sulphonated lorol, though an adverse influence was anticipated from chemical determinations by Fajans and Martin [ibid., xvi, p. 694].

In a limited number of comparative laboratory and field trials it was found that the results obtained on fungicides without supplements on leaf surfaces agree fairly well with their field performance. Lime-sulphur concentrations of 1 per cent., and concentrations of Bordeaux mixture, cuprous oxide, and cuprous cyanide equivalent to 0·1 to 0·2 per cent. copper, which showed a generally high level of fungicidal value in the laboratory leaf tests, are the concentrations actually effective for apple or pear scab in the field. The tendency, however, is for the laboratory tests to be somewhat less favourable to the fungicide than the field results. This was particularly marked in tests of fungicides with supplements, field tests showing no diminution of fungicidal value caused by the use of petroleum oil-sulphate lye emulsion with lime-sulphur [ibid., xvii, p. 696], whereas laboratory tests indicated such a reduction.

DAVIES (C.) & SMYTH-HOMEWOOD (G. R. B.). **Investigations on machinery used in spraying. Part V. Tabulated results of nozzle tests.**—*J. S.-E. agric. Coll., Wye*, xlii, pp. 9–36, 16 figs., 1938.

In this further paper of the present series [*R.A.M.*, xvi, p. 823] detailed tables are given showing the shape of the spray pattern made, the degree of fineness of the spray, and the degree of coverage obtained with 17 types of spray nozzles tested on 5 different spray guns at Wye.

SMITH (G.). **An introduction to industrial mycology.**—xii+302 pp., 127 figs., London, Edward Arnold & Co., Ltd., 1938. 16*s*.

This useful publication, written mainly for chemists and other workers with little or no previous training in biology, contains systematic descriptions and many excellent photomicrographic illustrations of fungi important in industry, belonging to the Zygomycetes, Ascomycetes and Fungi imperfecti, especially the genera *Aspergillus* and *Penicillium*. Introductory chapters deal with general morphology and

classification and the concluding ones with laboratory technique (cultivation and examination), industrial uses of fungi, and mycological literature.

GARDNER (H. A.), HART (L. P.), & SWARD (G. G.). **Mildew prevention [on painted surfaces] at Balboa, Cristobal, and Gainesville.**—*Circ. sci. Sect. nat. Paint Varn. Ass.* 558, pp. 112–132, 1938. [Abs. in *J. Soc. chem. Ind., Lond.*, lvii, 8 (*Abstr.*), p. 941, 1938.]

Data for mildew growth on panels coated with various white and coloured paints [*R.A.M.*, xvii, p. 615] after 318 days' exposure to favourable environmental conditions [in the Panama Canal zone, Colombia, and Florida] are tabulated. Zinc oxide was found to be the most resistant of the opaque white pigments. Lead phthalate produced little effect. Most of the rapidly chalking paints were immune. The addition of cuprous oxide and copper arsenite proved helpful. Mildew was not increased by the use of soy-bean and menhaden oils to give soft films. The efficacy of 48 added fungicides was established under the most exacting conditions. Ordinary soap and sodium phosphate applications are recommended for mildew removal.

BUCHWALD (N. F.). **Forslag til Udarbejdelse af fœllesnordiske Vulgaernavne paa Plantesygdomme.** [A proposal for the establishment of joint Scandinavian common names for plant diseases.]—Separate from *Beretn. N.J.F.'s Kongr., 1938*, 6 pp., 1938.

At the Congress of the Scandinavian Agricultural Union held at Uppsala, Sweden, in July, 1938, the following proposals were made in connexion with the drawing up of a collective list of Danish, Norwegian, Swedish, and Swedish-Finnish common names of plant diseases and injuries caused by viruses, bacteria, fungi, insects, and physiological or unknown factors in one or more of the Scandinavian countries (Finland included). On the basis of such a list a committee composed of representatives of each of the countries concerned will select the most appropriate designations in the three languages for the various diseases, and the completed catalogue will be published in *Nordisk Jordbruksforsking*. The Latin names of bacterial and fungal diseases will be based on the 'List of common names of British plant diseases' [*R.A.M.*, xiv, p. 325], and K. M. Smith's two books [ibid., xii, p. 776; xvii, p. 52] will constitute the foundation of the work on virus names. [The author *in litt.* states that these proposals were fully approved by the Congress and a committee was duly appointed.]

HANSEN (H. N.). **The dual phenomenon in imperfect fungi.**—*Mycologia*, xxx, 4, pp. 442–455, 4 figs., 1938.

The author states that analysis by the single-spore series method [*R.A.M.*, xi, p. 477; xii, p. 316; xiv, p. 710] of 916 isolates of imperfect fungi belonging to 30 genera showed that 485 or nearly 53 per cent. of these isolates were dual, i.e., were composed of two culturally distinct individuals. Cultures from a single spore gave rise to one of three types of growth, namely, one (*M*), producing abundant mycelium and few conidia; a second (*C*), producing many conidia and relatively less mycelium; and a third (*MC*) intermediate in its cultural characters between the other two, and most probably composed of

M and *C*. On further analysis by the same method it was found that the *M* and *C* types each invariably gave rise to cultures of their own respective type, while the third type again reproduced the three distinct types. When *M* and *C* were grown together in mixed culture, they combined, presumably by anastomosis, and reproduced the *MC* type. Besides differences in the quantity of mycelium and conidia produced, the two homotypes *M* and *C* may also differ in the structure of their mycelia. In *Phoma terrestris*, furthermore, the *M* and *MC* types produced pycnidia of the usual *Phoma* type, whereas the *C* type produced pycnidia with beaks frequently several times as long as the diameter of the pycnidium. As indicated by a few tests, the three types may also differ in virulence to their hosts; thus, for instance, the virulence of *P. terrestris* to onion roots was found to be in the decreasing order *M*, *MC*, and *C*, and of *Botrytis cinerea* to apple fruits in the decreasing order *MC*, *C*, and *M*.

Cultures of the *MC* type raised from fungi with multinucleate spores, such as *B. cinerea* and *P. terrestris*, usually varied considerably in their appearance, from nearly like *M* to almost identical with *C*; this is presumably due to the proportion of *M* and *C* nuclei these heterocaryotic cultures possess. There was evidence that in fungi with multinucleate spores the readiness with which the homotypes are obtained in single-spore series varies inversely with the nuclear number. In one strain of *B. cinerea* studied the nuclear number varied from 7 to 19 and from three to five consecutive single-spore series were required to bring out both homotypes. In *P. terrestris*, which has binucleate spores, there is only one *MC* type, and all three types invariably appear in the first series of single-spore cultures. In *Verticillium albo-atrum*, which produces mainly uninucleate spores, and in various *Fusarium* species, particularly those with few or no macrospores, it frequently happens that in the first 20-culture series only *M* and *C* homotypes are produced, and additional cultures, sometimes up to 50, are necessary to demonstrate that *M* and *C* nuclei may occupy the same spore.

The dual phenomenon appears to occur more frequently in isolates from the Sphaeropsidales and Melanconiales (70 per cent. of the 916 isolates studied) than in the Moniliales (47 per cent.). Among the two first-named orders, all the isolates of *Ascochyta pisi* (10), *Sphaeropsis* sp. (2), *Macrophoma* sp. (2), *Macrophomina phaseoli* (2), *P. terrestris* (104), *Stagonospora* sp. (1), and *Myxosporium* (2) tested were found to be dual, while among the last-named the condition was shown to occur in 144 out of 309 isolates of *B. cinerea*, 3 out of 7 *Hormodendrum* spp., 66 out of 139 of *Fusarium* spp., and 92 out of 183 of *V. albo-atrum* isolates. None of 30 conidial isolates from perfect fungi was found to be dual.

On general lines, the author considers that the evidence suggests that the nucleus rather than the cell is the basic unit of the individual [ibid., xii, p. 316], and indicates that the dual phenomenon is due to a condition of heterocaryosis. The presence of only two homotypes in the fungi analysed would suggest that the dual phenomenon is not merely an expression of genetic instability but rather an indication that duality is the normal condition for these fungi, and the frequency with which fungi were isolated in the *MC* form further suggests the normality of this condition. Though an explanation of the function

of the dual phenomenon is not offered, it is suggested that certain reactions, such as sectoring, reversion, loss of ability to sporulate, change in virulence, and the like, frequently observed under artificial culture conditions, may in many cases be best explained on the assumption that the fungi were obtained from nature in the dual heterocaryotic condition with subsequent dissociation into homotypes.

Kausche (G. A.). **Über die Trennung von Virusgemischen auf Grund der unterschiedlichen Säuren-Basenempfindlichkeit ihrer Komponenten.** [On the separation of mixed viruses on the basis of the differential reaction of their components to acidity.]—*Angew. Bot.*, xx, 3, pp. 246–256, 3 figs., 1938.

The English potato variety Sharpe's Express was observed at the Biological Institute, Dahlem, to develop symptoms suggestive of tobacco mosaic mixed with viruses of the X and Y group [*R.A.M.*, vii, p. 259]. The presence of the tobacco mosaic virus was confirmed by inoculations into tobacco, and a series of experiments was performed to determine whether the tobacco mosaic virus artificially mixed with X and Y potato viruses is soil-transmissible [ibid., ix, p. 207]. These all gave positive results for tobacco mosaic virus (except in the case of a pure crystalline preparation), whereas the potato virus components were not soil-transmissible.

Using the previously described method of separating mixed viruses by subjecting them to varying P_H values [ibid., xvii, p. 616], the author succeeded in separating the virus mixture isolated from Sharpe's Express into its component parts, viz., the tobacco mosaic virus, which became inactivated after 4 days at P_H values between 7·8 and 10·0, and the virus Cs 35 [ibid., xvii, p. 764]. This is believed to be the first report of the occurrence of tobacco mosaic on potato in Germany. A virus similar to Cs 35 has been isolated from the English varieties Arran Banner, Great Scot, and Ally.

Kausche (G. A.). **Über die Charakterisierung von pflanzlichen Virussolen mit kolloidem Gold.** [On the characterization of plant virus sols by means of colloidal gold.]—*Naturwissenschaften,* xxvi, 27, p. 445, 1938.

The reactions between the tobacco mosaic or X potato viruses and colloidal gold under varying experimental conditions were found to be classifiable according to Pauli's scheme (1932), and to afford a suitable method for the study of the purification of the viruses and their characterization [see preceding abstract].

Loughnane (J. B.) & Murphy (P. A.). **Dissemination of Potato viruses X and F by leaf contact.**—*Sci. Proc. R. Dublin Soc.,* N.S., xxii, 1–5, pp. 1–15, 1 diag., 1938.

An expanded account is given of the authors' study on the dissemination of potato virus X, a preliminary report of which has already been noticed from another source [*R.A.M.*, xvii, p. 479], together with additional experimental data on the dissemination of virus F and combinations of viruses. Virus F was found to be transmissible by leaf contact in the glasshouse under the same conditions as virus X. A single case of accidental transmission of Up-to-Date streak (virus B

or X+B) was observed in an insect-proof house and, in the absence of other known means, is ascribed to leaf contact. The combination of viruses X and B is stated to be more stable than the combination X and F, and has never yet been observed to segregate. From the existing evidence it is thought that some of the potato viruses are spread exclusively by leaf contact, or similar mechanical means, e.g., virus X and the virus complex X+B; some by insects or by both biological and mechanical means, with mechanical transmission predominating, e.g., virus F; by both means with biological transmission predominating, e.g., virus Y; and some by biological means only, e.g., leaf roll virus and possibly virus A.

CLINCH (PHYLLIS), LOUGHNANE (J. B.), & MURPHY (P. A.). **A study of the infiltration of viruses into seed Potato stocks in the field.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxii, 1–5, pp. 17–31, 1938.

This study was undertaken with the object of establishing the type and degree of virus infection arising in potato stocks growing in the seed-producing district of Donegal. The Champion and Arran Banner varieties were used for this purpose since both are susceptible to and tolerant of the principal mosaic viruses present. A list is given of all the viruses found in the country [*R.A.M.*, xvii, p. 479], comprising X (causing simple mosaic), A (veinal mosaic), Y (leaf-drop streak), F (tuber blotch), G (aucuba mosaic), X+A (crinkle), X+F (interveinal mosaic), X+Y (rugose mosaic), F+A (double virus aucuba mosaic), X+B (latent), E (latent in King Edward), and those causing leaf roll and witches' broom or wildings [ibid., xii, p. 48]. An examination of four different crops of Champion and five of Arran Banner from a stock believed to be virus-free in 1928 revealed 40 to 66 per cent. and 38 to 94 per cent. of latent X infection, respectively, no matter how isolated they had been when grown in the field in Donegal for five to seven years; 2 to 6 per cent. infection with virus A occurred in three crops, and 4 per cent. with virus B in three crops, accompanied by X in all cases; no other viruses were found. It is believed that the X infection was present at the time these stocks were propagated and subsequently spread within the crop. Seven crops of Champion from a stock proved to be virus-free in 1931, grown in moderate commercial isolation in the field in Donegal for from four to six years, showed complete absence of viruses X, Y, A, G, E, F, and leaf roll. The importance of the present Irish policy of building up seed potato stocks free from all viruses, including latent X, is stressed. It is concluded that potato crops can be maintained free from viruses transmitted through contact by growing the potatoes in moderate isolation, while freedom from insect-borne viruses can be easily achieved in districts (like Donegal) where both the viruses and the vectors are scarce.

CHOUARD (P.) & DUFRÉNOY (J.). **Essai sur les conditions de contamination des Pommes de terre par les maladies à virus en haute montagne.** [An experiment to determine the conditions of Potato contamination by virus diseases in the high mountains.]—*Bull. Soc. Acclim. Fr.*, lxxxv, 1–2, pp. 40–44, 1938.

Details are given of experiments in a mountain reserve of France

which proved that selected stocks of Majestic potatoes from Eire, free from leaf roll and virus Y, are liable to contract these diseases even at high altitudes unless precautions are taken to isolate the planting site, e.g., by a pine belt [cf. *R.A.M.*, xv, p. 680], from such sources of infection as old 'degenerate' potato stands and cabbage crops infested by aphis (*Myzus persicae*) [cf. ibid., xvi, p. 551]. Living aphids were found at an elevation of 2,200 m. No infection occurred on plants raised from virus-free Dutch seed. The yields of healthy potatoes at a height of 1,850 m. above sea-level greatly exceeded those obtained in well-known centres of production in the plains.

SMITH (A. M.) & PATERSON (W. Y.). **The examination of variety and virus disease in Potato tubers by a chemical test.**—*Scot. J. Agric.*, xxi, 3, pp. 240–248, 1938.

This is a semi-popular account of work already noticed from another source [*R.A.M.*, xvii, p. 266].

DENNIS (R. W. G.). **A new test plant for Potato virus Y.**—*Nature, Lond.*, cxlii, 3586, p. 154, 1938.

The author recently found that potato virus Y induces brown, circular, local lesions on leaves of *Lycium barbarum* seedlings about ten days after inoculation. When these lesions are very numerous, the inoculated leaves wilt and absciss; no systemic infection of the plant, however, results, as was confirmed by inoculations on tobacco and grafting experiments on susceptible potato varieties with material from the uninoculated part of the plant. The characteristic local lesions were given by inoculation with standard virus Y, a slightly different strain recovered from *Schizanthus* [*retusus*: *R.A.M.*, xvi, p. 703], and virus Hy II [ibid., xvii, p. 64: regarded by K. M. Smith as identical with potato virus Y], and were freely induced by strains of Y no longer readily sap-inoculable to tobacco. Sap from Y-infected potato, tobacco, and *S. retusus* was equally effective.

No other virus tested brought about a similar reaction, though faint local rings resulted from inoculation of *L. barbarum* with necrotic strains of viruses X and B. No visible lesions developed after inoculation with weak strains of X or potato viruses A, F, G, or the cucumber mosaic virus. A rather bright yellow mottling of the leaves resulted from infection with tomato aucuba mosaic [tobacco virus 6], this virus being recovered from the inoculated leaves. There was no evidence of the systemic infection of *L. barbarum* with any of these viruses, all of which, except virus A on potato, were obtained from infected tobacco plants. Inoculation to *L. barbarum* cannot be used to separate virus Y from a mixture of X and Y, but the reaction described may prove to be of value as a test for virus Y, especially when present in hosts other than tobacco.

STÖRMER (INGE). **Versuche zur Bekämpfung von Schorf und Rhizoctonia bei der Kartoffel durch quecksilberhaltige Dünge- und Beizmittel.** [Experiments in the control of Potato scab and *Rhizoctonia* by mercury-containing fertilizers and disinfectants.] —*Nachr. SchädlBekämpf., Leverkusen,* xiii, 2, pp. 45–54, 1 col. pl., 2 figs., 2 graphs, 1938.

Adequate control of potato scab (*Actinomyces*) [*scabies*] and *Rhizoc-*

tonia [*Corticium solani*] was given in recent experiments in Pomerania, Germany, on the Erstling [Duke of York] and Flava varieties by the application to the soil, preferably in the planting holes so as to secure close contact with the tubers, of 400 kg. superphosphate per hect. with the addition of 1 per cent. mercuric chloride. An acid medium (represented in this case by sandy soil with a P_H of 5) is essential for the release of the fungicidal properties of the mercury, which is immobilized in the presence of an alkaline fertilizer, such as calcium cyanamide. Of the preparations tested for Herulia tuber disinfection (by the short liquid process) 1 per cent. aretan [*R.A.M.*, xvii, p. 700] was the least injurious to the potatoes, besides being as effective (with a mercury content of only 3 per cent.) as mercuric chloride (70 per cent. mercury). Although attention in the present series of trials was directed mainly to the fungicidal efficiency of the treatments, yield increases of up to 30 per cent. were observed to result from the incorporation of mercuric chloride with soils badly infected with *C. solani*.

BURKE (O. D.). **The silver-scurf disease of Potatoes.**—*Bull. Cornell agric. Exp. Sta.* 692, 30 pp., 7 figs., 1938.

A full account is given of silver scurf of the potato, caused by *Spondylocladium atrovirens* [*R.A.M.*, xvii, p. 57], responsible in 1933 for considerable losses of stored potatoes to growers of certified seed on the muck lands, near Williamson, New York. The disease is hardly noticeable at the time of harvest but increases rapidly in storage. Inoculation experiments and field counts indicated that the infection may either take place on mature tubers in the soil before harvesting or during storage. The fungus penetrates a variable number of the phellem layers, but has not been observed in the living cells below the phellem. The cells in the outer layers are loosened by the action of the fungus and are readily sloughed off. Limited field data on varietal susceptibility showed that White Gold yielded no clean tubers, and 23·8 per cent. slightly, 28·6 moderately, and 47·6 per cent. severely affected tubers, whereas the heavily russeted variety U.S.D.A. Seedling No. 44537 had 95·2 per cent. clean and 4·8 per cent. slightly affected tubers, and Pioneer Rural, the next most resistant, 78·9 per cent. clean and 21·1 per cent. slightly affected tubers. Some of the russeted varieties were very susceptible. In cultural studies the optimum temperature for growth of the fungus was found to be 24° C., no growth occurring at 3° or 33°. Under controlled humidity conditions at 24° the best growth was obtained at 98·7 per cent. saturation. The fungus grew at a fairly wide P_H range (9·4 to 4·39) and was capable of adjusting the hydrogen-ion concentration of the medium (by lowering the high values and raising the low ones) in such a way that good growth occurred at any P_H at which initial growth could be obtained. In storage no new lesions were formed nor did old lesions enlarge at temperatures below 37° F. [2·8° C.] and at humidities below 90 per cent.

In trials with hot and cold chemicals both malachite green, applied for five minutes in a 1 in 100 cold solution, and a mixture of 0·5 gm. mercuric chloride with 0·5 gm. mercuric cyanide in 1,000 c.c. water, applied for five minutes, inhibited spore formation by the fungus and did not injure the tubers. Yellow oxide of mercury [ibid., xvi, p. 57 *et passim*]

dip (2 lb. to 30 gals.) reduced spore formation but did not inhibit it completely; used as a soil treatment (11·5 lb. per acre) this substance showed some promise, the treated plots yielding 10 per cent. potatoes affected with silver scurf as against 38 per cent. in the control plots. Prompt digging of the tubers at maturity and adequate adjustment of the temperature and the relative humidity of storage houses are considered promising protective measures against the spread of the disease.

PETTY (M. A.). **Potato spraying experiments in Louisiana during 1936–1937.**—*Amer. Potato J.*, xv, 7, pp. 189–191, 3 graphs, 1938.

The results of experiments to determine the value of spraying Houma and Triumph potatoes in Louisiana in 1936–7, using 4–4–50 Bordeaux mixture, with and without wyojel [*R.A.M.*, xvi, p. 478], indicated that the practice is profitable only when early blight [*Alternaria solani*] appears about a month before digging. In 1937, when the disease was absent, the treatment actually caused reductions in yield estimated at up to $53.70 per acre. The highest net profit in 1936 of $27.20 per acre was obtained from three applications of Bordeaux to Triumphs, the corresponding figure for five treatments of Houmas with the fungicide plus wyojel being $24.40.

IMURA (J.). **On the effect of sunlight upon the enlargement of lesions of the Rice blast disease.**—*Ann. phytopath. Soc. Japan*, viii, 1, pp. 23–33, 1938. [Japanese, with English summary.]

In order to determine the effect of sunlight on the enlargement of the lesions caused by *Piricularia oryzae* on rice leaves [*R.A.M.*, xvii, p. 767], potted seedlings were transferred straight from the inoculation chamber to four series of boxes (1) uncovered, (2) covered with one white cotton sheet, (3) covered with two white cotton sheets, and (4) covered with black paper. The maximum extension of initial infection took place on the slightly shaded seedlings, the minimum on those kept in the dark, but as time advanced the plants in the unshaded boxes showed the highest degree of lesion enlargement. In pure culture on potato dextrose agar containing 1 per cent. dextrose the fungus tended to develop more freely in comparative obscurity, although the differences in its growth under varying light intensities were not striking. The reaction of *P. oryzae* to shading in the early stages of infection is attributed to the direct influence of sunlight on its growth, as well as to the indirect effects of changes in the host vitality. In the later phases of the disease the diminution of assimilation products in the host clearly influences the response of the fungus to shading.

BEELEY (F.). **Annual Report. Pathological Division.**—*Rep. Rubb. Res. Inst. Malaya, 1937*, pp. 128–156, 1938.

The question of the most economic method of procedure for eradicating root disease of *Hevea* rubber (*Fomes lignosus*, *F. noxius*, and *Ganoderma pseudoferreum*) [*R.A.M.*, xvii, pp. 62, 624] when replanting old rubber areas still arouses controversy in Malaya. On some estates the areas to be replanted are dug over uniformly to a depth of 18 to 24 in. and all roots are removed, even if healthy. On others, the trees

are merely cut off at ground-level and eradication effected solely by routine treatment in the replanted stand. The most economical form of eradication would appear to lie between these extremes. To test this, two full-scale field experiments were laid down to compare statistically the method of selective patch-digging [ibid., xvii, p. 62] with the chief alternative methods, full details of which are given.

On a hilly estate, where the trunks and branches of the felled rubber were used to support the edges of the terraces, brown root rot (*F. noxius*) [ibid., xv, p. 345] appeared among *Tephrosia vogelii* cover plants below the logs on the banks of the terraces. There being no evidence that the logs had become infected by contact with the soil or with buried infected roots, the infection was attributed to wind-borne spores. The indicator plants were carefully watched, and all infected logs destroyed, with the result that the outbreak was quickly controlled.

Even under 'forestry' conditions, comparative safety from mouldy rot (*Ceratostomella fimbriata*) [ibid., xvii, p. 62] can be assured if the covers are slashed to 2 ft. just before the onset of the wet season, and clean-cleared rentices 8 ft. wide are provided along the rows to promote the movement of air currents and ensure a more rapid drying of the bark after dew or rain.

Of the bark cankers previously reported as due to physiological disturbance [ibid., xvi, p. 60], those left untreated appear to have remained inactive, while those deeply scraped have regenerated healthy bark.

KURSANOFF (L. I.) & SHKLYAR (T. N.). Сравнительное изучение микофлоры московских и батумских почв. [A comparative study of the fungus flora of soils from Moscow and Batum.]—*Bull. Soc. Nat. Moscou*, Sect. biol., N.S., xlvii, 3, pp. 223–232, 1938. [French summary.]

With the object of disclosing differences in the biological activities of fungi in soils of different composition and of different geographical origin the authors examined five specimens of soil from Ostankino (55° N.) near Moscow, taken from woodlands and from tree nurseries, cultivated and manured for five years, and five specimens of soil from Gonio (41° 45′ N.) near Batum [Caucasus] taken from woods and grass-lands and from a citrus plantation, cultivated and treated with manure and chemical fertilizers for ten years. About half the species were common to both groups of soils. Among the 44 fungi listed, are *Botrytis epigaea*, *Clasterosporium carpophilum*, *Diplocladium macrosporium*, *Diplosporium album*, *Hormodendrum pallidum*, *Helicoon tubulosum*, *Monosporium acuminatum*, *Spicaria decumbens*, *Tilachlidium humicola*, *Verticillium glaucum*, *Mortierella pusilla*, 11 species of *Mucor*, *Thamnidium elegans*, *Zygorrhynchus heterogamus*, and *Z. mölleri*. The differences in the microflora of the two groups of soils became more apparent in further studies. The average number of fungal spores per gm. of soil, calculated from the results of five replications, was 54,000 for all five specimens of southern soils from Gonio and 119,000 for the northern soils from Ostankino. Species of *Penicillium* were prevalent in both the northern and the southern soils,

amounting to 66·5 and 68·8 per cent., respectively; and were followed by *Trichoderma* (16·9 per cent.) and *Fusarium* (4·2 per cent.) in the former and *Aspergillus* (8·9 per cent.) and *Trichoderma* (4·5 per cent.) in the latter. On the whole Hyphomycetes predominated in southern soils and Mucorales in those of the northern area. The cultivated and manured soils of both groups contained larger numbers of fungi, especially Mucorales, than the uncultivated. The relative capacity of different species of fungi to decompose cellulose was tested in Cholodny's soil chamber [ibid., xvii, p. 554], into which a few fibres of cotton wool were introduced. Of the cellulose-destroying fungi present in northern soils the most frequent was *Trichoderma lignorum*, followed in order by *T. koningi*, *Penicillium* spp., *Acrostalagmus albus*, *Fusarium* spp., and *Tilachlidium humicola*; whereas with the southern soils the sequence was: *Penicillium* spp., *Aspergillus* spp., *Acrostalagmus albus*, *Trichoderma lignorum*, *T. koningi*, *Alternaria humicola*, and *Cephalosporium acremonium*. The fungi present in the southern soils were found collectively to decompose cellulose more rapidly than those in the northern; individually the species *T. lignorum* and *T. koningi* were the most active in both groups of soils. The individual activity of the fungi was measured both by the number of days needed to decompose a given amount of cellulose and by the percentage of cellulose decomposed during a given number of days. It appears from these results that the biological activity of the different species is directly correlated with their degree of prevalence in the soil.

MILOVTZOVA (Mme M. O.). Нові види грибів на лікарських і етероелійних рослинах УРСР. [New species of fungi on the medicinal and essential oil plants of the Ukraine.]—Труд. Інст. Бот. Харк. Держ. Унив.—[*Trav. Inst. Bot. Univ. Kharkoff*], ii, pp. 7–13, 4 figs., 1937. [Received July, 1938.]

The author describes and gives the Latin diagnoses of several new species, forms, and one new variety, of fungi found on cultivated and wild medicinal plants in the vicinity of Kharkoff. *Ophiobolus origani* n.sp., *Camarosporium origani* n.sp., and *Diplodina origani* n.sp. are stated to occur on the dry stems of *Origanum vulgare*. *Macrosporium digitalis* n.sp. causes rounded spots 1·5 to 3 mm. in diameter on living leaves of *Digitalis ambigua* and *D. purpurea*; it has straight, cylindrical, dark olive conidiophores, either scattered or in groups of two or three, 55 to 76 by 5 to 8 μ, and clavate conidia, brown with a paler apex, 88 to 136 by 12 to 24 μ, with 5 to 9 transverse and 1 to 2 longitudinal septa. *Erysiphe cichoracearum* f. *carthami* n.f. and *Bremia lactucae* f. *carthami* n.f. were found on living leaves of *Carthamus tinctorius*, and *Urocystis anemones* var. *adonis* n.var. occurred on the leaves, stems, and flowers of *Adonis vernalis*.

SALMON (E. S.) & WARE (W. M.). **The downy mildew of the Hop in 1937.**—*J.S.-E. agric. Coll., Wye*, xlii, pp. 42–46, 1938.

An account is given of the hop downy mildew [*Pseudoperonospora humuli*: *R.A.M.*, xvii, p. 374] situation in England in 1937, when early outbreaks ceased, following dry weather, and the crop gathered was free from infection. Data are supplied showing that for the sixth successive

year rainfall did not exceed the normal in both July and August, and the authors consider that this has largely contributed to the prevention of a major disaster to the hop crop in those years.

Cottonseed oil-Bordeaux mixture was favourably reported on by a number of Kentish growers as possessing improved wetting qualities and reducing the wear of the pumps. It also gave excellent results in two gardens in which it was tested by the authors.

All of ten laterals of the Fuggles variety heavily sprayed in full burr with cuprous oxide [ibid, xv, p. 283], the 'brush' being thoroughly wetted, subsequently bore well-developed, uninjured cones with as many seeds as those in adjacent, unsprayed laterals.

Bouriquet (G.). **Les maladies de la Canne à Sucre à Madagascar.** [Sugar-Cane diseases in Madagascar.]—*Agron. colon.*, xxvii, 247, pp. 1–17, 1938.

In this semi-popular account of the principal diseases of sugar-cane, with special reference to conditions obtaining in Madagascar, the author states that no streak or mosaic has so far been found on the island, though *Aphis maidis* is present. The Port Mackay variety frequently shows variegation (large, white, longitudinal bands on the leaves), the cause of which is not known, but appears to be unharmed by it. *Leptosphaeria sacchari* [*R.A.M.*, xvi, p. 127] has been noted in various localities, on all varieties, including *Saccharum spontaneum*, but is very rare in the west, where the sugar-cane is stated to be extraordinarily healthy. No control methods are considered necessary. Leaf scald (*Bacterium albilineans*) was observed in June, 1935, in one locality (Nossi-Bé). Smut (*Ustilago scitaminea*) [ibid., xvii, p. 97] was also found at Nossi-Bé in June, 1935; locally, the spores are round, 6 to 8·5 μ in diameter, and have a smooth, brown membrane. Sooty mould occasionally appears on the eastern side of the island, but is of negligible importance. *Coniothyrium* [*Pleocyta*] *sacchari* [ibid., xvi, p. 796; xvii, p. 66] was found in December, 1930. *Schizophyllum commune* has been found on old cane wood, but never on living cane. Root rot associated with *Dictyophora multicolor* [ibid., xi, p. 128] was first observed locally in 1930. *Colletotrichum falcatum* has been reported from Madagascar but has never been observed by the author.

Kiryu (T.). **Studies on the physiological characters of Cercospora vaginae Krüg.**—*Rep. Govt Sug. Exp. Sta. Tainan*, 5, pp. 53–72, 2 pl., 2 graphs, 1938. [Japanese, with English summary.]

The best of the ten solid media tested for the development of *Cercospora vaginae*, the agent of the red spot of the sugar-cane leaf sheath [*R.A.M.*, xvi, p. 127] now prevalent in Formosa, Japan, was found to be potato sucrose agar (15 per cent. sucrose). The temperature range for growth was from 7° to 37° C., with an optimum at or near 28°. *C. vaginae* developed throughout a hydrogen-ion range of P_H 1·3 to 12·5, the optimum lying between 5·6 and 6. The addition to the agar media of 0·3 to 0·5 per cent. common salt stimulated growth, while the fungus was able to tolerate up to 5 per cent. The aerial mycelium and conidia of the fungus were found to grow somewhat better in the light than in darkness, although development as a whole was favoured

by obscurity. Exposure to moist heat at a temperature of 55° for 30 minutes or 58° for 5 minutes killed the mycelium and conidia of *C. vaginae*.

Kiryu (T.). **Studies on the Cytospora sheath disease of Sugar Cane. Part I. Studies on the physiological characters of Cytospora sacchari Butl.**—*Rep. Govt Sug. Exp. Sta. Tainan*, 4, pp. 172–194, 2 pl., 2 graphs, 1937. [Received September, 1938.]

The *Cytospora* sheath disease of sugar-cane, caused by *C. sacchari* [*R.A.M.*, xvi, p. 341], is stated to be prevalent in the southern part of Formosa, especially where P.O.J. 2883 is cultivated. In culture the mycelium grew best on soy-bean agar and less well on the following agar media in declining order: sugar-cane stem, onion, potato sucrose, Pfeffer's, modified albumin, Czapek's, and sugar-cane leaf, but aerial development was most abundant on sugar-cane leaf, potato sucrose, and soy-bean agars. The fungus grew at temperatures ranging from 7° to 37° C., with an optimum at about 31°. It was able to grow on agar media containing from 0 to 30 per cent. sucrose, but the optimum concentration was 10 per cent. The addition of common salt to the medium was tolerated to a maximum of 5 per cent., the optimum concentration being 0·5 per cent. Growth of the fungus took place between P_H 1·2 and 9·8, the optimum being 4 and 3·0 to 5·0 giving quite good results. Darkness was more favourable to growth than light, though the aerial mycelium developed rather better in the light than in the dark. The mycelium of the fungus was killed at 49° (moist heat) after 30 minutes' exposure and at 52° after 5 minutes.

Chlorotic streak in Louisiana. Committee Report, American Sugar Cane League.—*Sug. Bull., New Orleans*, xvi, 18, pp. 2–3, 1938. [Abs. in *Facts ab. Sug.*, xxxiii, 10, p. 74, 1938.]

Chlorotic streak [fourth disease] of sugar-cane [*R.A.M.*, xvii, p. 345] appears to have evaded the quarantine regulations and become established in Louisiana, where it is particularly prevalent on C.P. 29–320 and other C.P. types as well as on Co. 281; Co. 290, on the other hand, has hitherto been free from infection. The symptoms of the disease are briefly described.

Bell (A. F.). **Downy mildew disease of Cane.**—*Cane Gr. quart. Bull.*, vi, 1, pp. 30–32, 1938. [Abs. in *Facts ab. Sug.*, xxxiii, 10, p. 75, 1 fig., 1938.]

In connexion with a popular note on downy mildew of sugar-cane [*Sclerospora sacchari*] in Queensland [*R.A.M.*, xvii, p. 772] the writer emphasizes the difficulty of detecting the white efflorescence on the leaves during the dry winter and early spring weather. The presence of the disease may be recognized at this period, however, by the sudden elongation of a proportion of the affected stalks, which are thin, soft, brittle, and stand out a couple of feet above their neighbours ('jump-up' phase). During the cool season the disease spreads very slowly and may be combated by roguing and selection of healthy planting material from sites at least a quarter of a mile distant from any known centre of infection.

Ito (S.) & Homma (Yasu). **Notae mycologicae Asiae orientalis. III.** [Mycological notes from eastern Asia. III.]—*Trans. Sapporo nat. Hist. Soc.*, xv, 3, pp. 113–128, 1938.

This further list of fungi, mostly rusts, reported from Japan and the Far East [*R.A.M.*, xv, p. 829] includes *Phakopsora nishidana* S. Ito n.sp. (*P. fici* Nishida nom. nud.) [with a Latin diagnosis] found on leaves of *Ficus carica* and *F. erecta* at Kyushu. It is characterized by uredosori on the under surfaces of the leaves, found in yellow-brown, sparse or aggregated spots 0·2 to 0·3 mm. in diameter, which are at first covered by the epidermis, but are later bare and pulverulent. The sparse, peripheral or intermixed, clavate, hyaline paraphyses measure approximately 26 by 10 μ. The globose, ellipsoid or ovate, yellow or yellow-brown uredospores measure 18 to 24 by 16 to 18 μ; the verrucose epispore is approximately 1 μ thick and the germination pore dark. The subepidermal, sparse or aggregated teleutosori are present on the under surfaces of the leaves in reddish-brown spots 0·2 to 0·8 mm. in diameter. The oblong, yellow teleutospores occur in layers of 2 to 4 and measure 15 to 20 by 8 to 12 μ; the epispore is about 1·5 μ thick. A key is given to the species of *Puccinia* found on Japanese Cyperaceae.

Kirschstein (W.). **Ascomycetes.**—*Kryptogamenflora der Mark Brandenburg*, viii, 3, pp. 305–448, 11 figs., 1938.

In the last instalment of this flora [issued in 1911], the author began on the last two pages the family Mycosphaerellaceae. As his views on the nomenclature of this family have now altered, he starts afresh the account of the family adopting the name Sphaerellaceae instead of Mycosphaerellaceae and accepting the generic name *Sphaerella* in place of *Mycosphaerella*. The present fascicle contains a key to the 14 genera discussed, and comprises four new genera (including *Thyrospora* [but see *R.A.M.*, v, p. 233]), 17 new species [with Latin diagnoses], 26 new combinations, and 5 new names. Among the synonyms of the type species of *Saccothecium*, *S. sepincolum* Fr., is *Sphaerulina intermixta* (Berk. & Br.) Sacc., and the genus *Sphaerulina* is reserved for species based on *S. myriadea* (DC) Sacc.

Mix (A. J.). **The genus Taphrina. I. An annotated bibliography. II. A list of valid species.**—*Kans. Univ. Sci. Bull.*, xxiv, 9, pp. 113–149; 10, pp. 151–176, 1936. [Received October, 1938.]

The first part of this work presents a critical annotated bibliography (comprising 189 items) from 1815 onwards of the genus *Taphrina*, including *Ascomyces*, *Exoascus*, and *Magnusiella*, and in the second part a descriptive list (with references to literature, hosts, characters of the asci and spores, and distribution) is given of 104 valid and one doubtful species of *Taphrina*, eight being excluded.

Ciferri (R.). **Flora italica cryptogama. Fasc. 17. Pars 1: Fungi. Ustilaginales: Tilletiaceae, Graphiolaceae, Ustilaginaceae.** [The cryptogamic flora of Italy. Fasc. 17. Part 1: Fungi. Ustilaginales: Tilletiaceae, Graphiolaceae, Ustilaginaceae.]—443 pp., 21 figs., 2 diags., Soc. bot. ital., 1938.

This copiously annotated list of Italian Ustilaginales, preceded by

a general account of the history, morphology, biology, cytology, host relations, physiologic specialization, taxonomy, geographical distribution, and other features of the group, contains a new genus, *Ginanniella*, with its type species *G. trientalis* (*Tuburcinia trientalis* Berk. & Br.), four new species [with Latin diagnoses], and twelve new combinations. A combined host and fungus index is appended.

Liro (J. I.). **Die Ustilagineen Finnlands. II.** [The Ustilagineae of Finland. II.]—Reprinted from *Ann. Acad. Sci. Fenn.*, Ser. A, xlii, 1, xiii+720 pp., 8 figs., 1 map, 1938.

Twenty-eight new species [with diagnoses in German only] and 12 new combinations are included in this further critically annotated list of Finnish Ustilagineae [*R.A.M.*, iii, p. 369], which is divided into two main sections, the first dealing with the taxonomic aspects of the fungi enumerated and the second presenting a fully documented survey of the available information on some problematical questions concerning the biology of certain representatives of the group. A bibliography of 122 pages and a combined host and fungus index are appended.

Roger (L.). **Quelques champignons exotiques nouveaux ou peu connus. III.** [Some new or little known exotic fungi. III.]—*Bull. Soc. mycol. Fr.*, liv, 1, pp. 48–54, 1 pl. [in fasc. 2], 2 figs., 1938.

Continuing his earlier studies [*R.A.M.*, xv, p. 830], the author gives notes, with technical descriptions [in French only], on three new fungi from Africa.

Hemileia pavetticola Maubl. & Rog. n.sp., found on the leaves of *Pavetta ternifolia* in the Belgian Congo, resembles *H. coffeicola* [ibid., xiv, p. 303] but differs in that its mycelium spreads very little in the spongy parenchyma, and the haustoria are much more finely lobed.

Dothiorella sisalanae n.sp. produces broad, dry areas on the leaves of *Agave rigida* var. *sisalana* in French Guinea. Fructifications develop on both surfaces, and the mycelium forms black, subepidermal, later erumpent, round or elongated pustules. The stromata measure 400 to 800 μ long by 250 to 500 μ high, and contain one or two layers of pycnidia arranged in groups of 2 to 6 or more. When the pycnidia are isolated, which occurs occasionally, the wall is very thick, and each should be regarded as constituting a unilocular stroma. The locule averages 165 to 210 μ in diameter. The ovoid, 1-celled, hyaline spores measure 10 to 12 by 3·2 to 5·3 μ, are rounded at the extremities, and are borne on long, slender sterigmata, which may reach the same length as the spore.

Microthyriella guineensis n.sp. forms flat, black, circular, easily detachable colonies $\frac{1}{2}$ to 1 mm. in diameter on the leaves of *Coffea liberica* in French Guinea, usually on the upper surface. The brown mycelium is 16 to 20 μ thick and slightly vermiculate. Underneath the cells of the fungal crust the true wall of ascostroma is distinctly visible, and consists of light-coloured cells elongated perpendicularly to the leaf surface. The broad, short asci measure 110 to 140 by 60 to 70 μ, and contain 8 massed, rectilinear, often curved, hyaline ascospores slightly constricted at the median septum, rounded at the extremities, and measuring 70 to 100 by 14 to 18 μ.

Roldan (E. F.). **New or noteworthy lower fungi of the Philippine Islands, II.**—*Philipp. J. Sci.*, lxvi, 1, pp. 7–13, 4 pl., 1938.

An annotated list is given of twelve fungi, six of which are described [with English and Latin diagnoses] as new to science, while the remainder are recorded for the first time from the Philippine Islands [cf. *R.A.M.*, xvi, p. 209]. *Cercospora vaginae* was collected on living leaf sheaths of sugar-cane [see above, p. 839]. Living foliage of tomato is attacked by *C. fuligena* n.sp., which forms its dark brown colonies, composed of simple, fasciculate subgeniculate, septate conidiophores, 26 to 67 by 3·7 to 5 μ, on the under sides of the leaves. The conidia of the fungus are clavate to subclavate, slightly curved, subhyaline, uni- to pluriseptate, acrogenous, and measure 15 to 118 by 3·5 to 5 μ. The species is stated to differ from *C. cruenta*, reported from the United States, in producing colonies and not spots on the tomato leaves. *Cylindrosporium insularum* n.sp. produces sparse, circular, pale yellow, reddish-edged, grey-centred lesions, 2 to 30 mm. in diameter, on living leaves of *Lansium domesticum*. *Macrosporium centaureae* n.sp. forms irregularly circular, pale yellow spots, 1 to 15 mm. in diameter, with reddish-brown borders, on living leaves of *Centaurea* sp. Living cassava foliage is liable to infection by *Helminthosporium hispaniolae* [ibid., xiii, p. 147], which produces scattered or confluent, circular, light brown to pale straw-coloured spots, mostly on the old basal leaves. A serious leaf blight of the vine, characterized by the development of numerous chocolate-brown spots, 1 to 10 mm. in diameter, is caused by *Isariopsis clavispora*. *Acrothecium rubiginosum* n.sp. is recorded on living leaves of *Eurycles amboinensis*. *Piricularia cannae* n.sp., the agent of a foliar blight of *Canna indica* leaves characterized by irregular, confluent, dark brown patches, differs from *P. grisea* [ibid., xvi, p. 195] in its much larger conidia, which are ovate to piriform, septate, formed terminally in a scorpioid cyme, and measure 35 to 49 by 14 to 21 μ. Light brown, predominantly marginal, sometimes confluent patches are produced on living bean (*Phaseolus vulgaris*) leaves by *Macrophoma phaseolina* [ibid., viii, p. 743] with pycnidia 55 to 163 μ in diameter, and subcylindric conidia, 18·5 to 28 by 7·5 to 11 μ. *Phyllosticta heveae* forms light brown, concentrically zonate spots on rubber leaves [ibid., v, pp. 324, 690]. Scattered or confluent, circular, pale yellow spots, 1 to 10 mm. in diameter, with narrow, reddish-brown borders, are produced on living foliage of *Phytolacca dioica* by *Phyllosticta phytolaccae*. The ovate to piriform pycnidia and elliptical to ovate-elliptical pycnospores of *Cicinnobolus sigacollus* n.sp., parasitizing the hyphae of Erysiphaceae on *Cucurbita maxima*, measure, respectively, 48 to 81 by 41 to 56 μ and 4·5 to 7·5 by 2·5 to 3·5 μ, and are thus larger than those of *Cicinnobolus cesatii* [ibid., xvi, p. 104].

Reid (J. J.), McKinstry (D. W.), & Haley (D. E.). **Studies on the fermentation of Tobacco. 2. Microorganisms isolated from cigar-leaf Tobacco.**—*Bull. Pa St. Coll.* 363, 18 pp., 6 figs., 3 graphs, 1938.

A study of 2,844 pure culture isolations of micro-organisms from 354 samples of cured and fermenting cigar-leaf tobacco in Pennsylvania [cf. *R.A.M.*, xvii, p. 566] showed, *inter alia*, that the predominant fungi

on the cured leaf belonged to *Penicillium* and *Aspergillus*, the former genus occurring more frequently than the latter. Viable fungi disappeared entirely in the early stages of fermentation.

HOPKINS (J. C. F.). **Mycological notes. Seasonal notes on Tobacco diseases. II. Two destructive curing moulds.**—*Rhod. agric. J.*, xxxv, 7, pp. 510–512, 2 figs., 1938.

Barn rot of tobacco caused by *Rhizopus arrhizus* [cf. *R.A.M.*, xiv, p. 678] and yellow mould caused by *Aspergillus flavus* are reported to have been fairly prevalent in the barns in Southern Rhodesia in 1938 during curing, owing to high humidity, insufficient aeration, and close packing. The barn rot disease causes a softening of the midrib of the leaf at the butt end, the butts soon turning dark brown and the leaf tissues becoming wet and soggy, while a grey, mouldy growth of the fungus spreads all over the infected area. Yellow mould is not of frequent occurrence but may cause appreciable damage under conditions favouring barn rot. Not uncommonly both diseases occur on the same leaf. *A. flavus* produces small, medium-brown, circular spots scattered over the leaf, increasing in size to a diameter of about half-an-inch, with small, circular patches of the yellow fungus in the centres of many of the spots. Sometimes several spots coalesce to form large discoloured areas. This is believed to be the first record of *A. flavus* causing a leaf spot of tobacco. In order to prevent heavy losses from these diseases the growers are advised to arrange the priming so that the amount of harvested leaves to be cured should not be in excess of the available barn accommodation.

KOCH (L. W.). **Blue mold of Tobacco in Canada.**—*Lighter* (*Dep. Agric. Can.*), viii, 3, pp. 8–9, 1938. [Mimeographed.]

Tobacco downy mildew (*Peronospora tabacina*) [*R.A.M.*, xvii, p. 777] was reported for the first time in Canada on 7th June, 1938, near Essex, Essex County, Ontario, where 1,200 sq. ft. of Judy's Pride seedlings were severely damaged. Seedlings of Halley's Special variety growing on a neighbouring plantation were also affected, and the disease was subsequently discovered in other localities in the neighbourhood including one place five miles west and one 60 miles south-east of Essex. All the affected plants and all those likely to become affected were destroyed. At Harrow, 15 miles from the scene of the original outbreak, the meteorological data showed that on 27th to 29th May, inclusive, the mean temperature was 61·1° F. and the average relative humidity 82 per cent. It is suggested that the outbreak may possibly have been due to sporangia carried in the air across Lake Erie.

CLAYTON (E. E.). **Paradichlorbenzene as a control for blue mold disease of Tobacco.**—*Science*, N.S., lxxxviii, 2272, p. 56, 1938.

Experiments recently conducted in two localities of Georgia and South Carolina showed that effective control of tobacco blue mould (*Peronospora tabacina*) under greenhouse conditions was attained by scattering paradichlorbenzene crystals on boards, at the rate of 1 oz. to 4 or 5 sq. yds. of bed area; in one experiment, placing the crystals on a narrow shelf running inside and near the top of the side walls of

a bed 9 ft. wide gave adequate control of the mould throughout the bed. Treated beds were enclosed at night with muslin sheeting to retain the vapours given off by the crystals. It is pointed out that 1 oz. by weight of paradichlorbenzene was equal in effectiveness to 5 fluid oz. of benzol [*R.A.M.*, xvii, p. 777]. If these results are confirmed by more extensive tests, paradichlorbenzene will mark a step forward towards simplifying blue mould control and reducing its cost.

McKnight (T.). **Further experiments on mildew prevention in calico with special reference to Tobacco seed-bed covers.**—*Qd agric. J.*, l, 1, pp. 4–7, 1938.

In further tests with sixteen different substances for preventing moulding of calico covers used on tobacco seed-beds undergoing benzol disinfection against downy mildew [*Peronospora tabacina*: see preceding abstracts], 10 minutes' immersion in colloidal copper with agral II added as spreader resulted in no moulding of the calico after six months and the covers so treated had a strength after exposure of 66 lb. per sq. in. (i.e., pounds pressure required to fracture the cloth) and waterproofing quality of 3 minutes' duration (number of minutes taken for 90 c.c. of water to percolate through a standard depression made in the calico tied over a jar). The best all-round results were given by various treatments with alum lead acetate. When the standard schedule for this material was used, involving immersion in two solutions [*R.A.M.*, xvii, p. 77], there was slight moulding after six months, while the figures for strength and waterproofing were 96 lb. and 6 minutes, respectively. A single immersion in a combination of the two alum and lead acetate mixtures, and in the same plus either 1 per cent. glue size or 3 per cent. gelatine, gave slight to moderate moulding after six months with, respectively, strengths of 93, 91, and 95 lb. per sq. in., and waterproofing durations of 5, 10, and 210 minutes. Shirlan W.S. (1 per cent.) gave slight to moderate moulding, a strength of 57 lb. per sq. in. and a waterproofing duration of 3 minutes, the corresponding values for shirlan W.S. (0·25 per cent.) being serious moulding, 73 lb., and 3 minutes, and for shirlan AG (1 per cent.) moderate to serious moulding, 87 lb., and 3 minutes.

As a result of these tests it is recommended that the calico covers should be immersed in a solution of 2 lb. alum and 1 lb. lead acetate in 10 gals. water for 24 hours, and then removed and allowed to dry.

Curtis (K[athleen] M.) & Allan (J. M.). **Tobacco mosaic in New Zealand. Incidence with reference to commercial practice in glasshouse, seedling-bed, and field, season 1937–38.**—*N.Z.J. Sci. Tech.*, A, xx, 1, pp. 1–13, 1938.

In a large-scale experiment carried out in 1937–8 in the Nelson District of New Zealand with the co-operation of two of the principal tobacco companies no evidence was obtained that the customary practice of raising tobacco seedlings in commercial glasshouses in which tomatoes are regularly grown is responsible for infecting the young tobacco seedlings with mosaic. The tabulated results showed that under the experimental conditions the raising of tobacco seedlings in glasshouses not used for tomatoes did not prevent the development of

mosaic in the seedlings in the bed. Furthermore, when the beds were treated with formalin applied at the rate of 12 gals. of 4 per cent. solution per bed (12 ft. by 4 ft.) before pricking out seedlings raised in a non-tomato glasshouse, no mosaic occurred at the bed stage, but the disease appeared in the field after transplanting. The marked increase in infection that occurred between the bed and field recordings indicates the importance of the bed phase (from pricking out to transplanting) in the multiplication of mosaic. Handling and cultural operations after planting in the field were less important in promoting spread than they were during the bed phase, as secondary field infection took place too late seriously to affect the development of the crop leaves.

STANLEY (W. M.). **Isolation and properties of Tobacco mosaic and other virus proteins.**—*Bull. N.Y. Acad. Med.*, Ser. 2, xiv, 7, pp. 398–428, 4 figs., 1 diag., 3 graphs, 1938.

In this paper (Harvey Lecture, 17th March, 1938) the author traces the history of viruses from the first mention of invisible living agents as possible causes of disease by Varro and Columella (*c.* 100 and 60 B.C., respectively) to the most recent discoveries in this field of research, with special reference to tobacco mosaic. The implications of the latest evidence on the physical, chemical, biological, and serological properties of virus proteins are discussed in an interesting and suggestive manner [cf. *R.A.M.*, xvii, p. 407].

HILLS (C. H.) & VINSON (C. G.). **Particle size of Tobacco mosaic virus.**—*Res. Bull. Mo. agric. Exp. Sta.* 286, 18 pp., 2 graphs, 1938.

The particle size of the tobacco mosaic virus [*R.A.M.*, xvii, p. 707] was calculated in diffusion experiments in the following way. Four different solutions of the virus obtained from the juice of diseased plants of Turkish tobacco and having a P_H value of about 5·0 were allowed to diffuse into a certain volume of distilled water. The virus concentrations of the diffusates were determined by the half-leaf method of Samuel and Bald [ibid., xii, p. 526], using the leaves of *Nicotiana glutinosa* and *Phaseolus vulgaris*. The diffusion coefficient (D) was then calculated from an equation [given in full] in which $D =$ virus concentration of the diffusate $\times$ the volume of the diffusate. The relation between the radius of the virus molecule (r) and D being developed from Einstein's equation [also given in full], the average value of r was now calculated from 9 diffusion experiments as $4{\cdot}09 \pm 0{\cdot}31\ \mu\mu$. In the presence of trypsin the average value of r was $17{\cdot}40 \pm 1{\cdot}59\ \mu\mu$; this increased particle size is probably due to the adsorption of trypsin by the virus and such an adsorption was also indicated by the more rapid diffusion of trypsin (33·6 per cent. greater) from a trypsin solution free from virus than from one containing virus. The isoelectric points of the protein particles in highly purified virus preparations from Turkish tobacco, *N. macrophylla*, and Marglobe tomato were calculated from viscosity measurements as P_H $3{\cdot}6 \pm 0{\cdot}1$.

MOORE (E[NID] S.) & HEAN (Miss A. F.). **Frenching of Tobacco.**—Reprinted from *Fmg S. Afr.*, xiii, 2 pp., 3 figs., 1938.

A brief, popular account is given of the symptoms and etiology of

tobacco frenching [*R.A.M.*, xvi, p. 637], which has recently been observed for the first time in the Union of South Africa. Only a few cases have been observed locally, either in the seed-beds or the field, and in every instance the soil conditions were found to be unsuitable for tobacco.

Moore (E[nid] S.) & Retief (D. F.). **Mildew or white rust of Tobacco.**—Reprinted from *Fmg S. Afr.*, xiii, 2 pp., 1 fig., 1938.

In this popular note the authors state that the advent of flue-curing of tobacco in South Africa has rendered mildew (*Erysiphe cichoracearum*: *R.A.M.*, xvi, p. 780; xvii, p. 295] of much more serious import than it was formerly, since leaves that when harvested showed only a trace of infection become so badly marked during flue-curing as to be worthless.

In two seasons' tests in which plots were dusted (A) one month or (B) two months after planting with finely divided, high quality sulphur, precautions being taken to minimize the risk of sulphur blowing from one plot to another, the disease was scarce even in the controls in the first season, but in the second infection was severe on the untreated controls, and the efficacy of the treatment was fully confirmed. The single application gave several weeks' protection, and at harvest time the plots in series A had considerably less infection than the controls: the plots in series B had even less disease than series A. Appreciable quantities of sulphur were, however, demonstrated to be present, by chemical analysis at harvest time, on all the leaves of the dusted plants, and sulphur was even recovered from leaves that had developed after the dusting. To what extent the sulphur is removed during air or flue-curing is not yet known, but the treatment is unreservedly condemned. Applications of sulphur to the soil at the rate of 60 lb. per acre before planting failed to control the disease. Growers are advised to make a fuller use of priming for control purposes [ibid., xv, p. 470].

Birch (T. T. C.). **A synopsis of forest fungi of significance in New Zealand.**—Reprinted from *N.Z. J. For.*, iv, 2, 17 pp., 1937. [Issued as *Bull. N.Z. For. Serv.* 9, 1938.]

This is a list of 62 of the more important species of forest fungi in New Zealand together with the names of the hosts affected, the world geographical distribution of the fungus species, notes on their pathogenicity, and book references. A preliminary list of 7 mycorrhizal fungi is appended.

Wakefield (W. E.). **Brown-stain in Sugar Maple. Its effect on the mechanical and physical properties.**—*Circ. For. Serv. Can.* 53, 8 pp., 3 figs., 1938.

Canadian sugar maple (*Acer saccharum*), used for the manufacture of last-blocks for boots and shoes, occasionally shows in the region adjacent to the pith a dark brown discoloration, which may occupy from 50 to 75 per cent. of the total area of the cross-section of the log. This dark wood, usually referred to as 'brown heart', is surrounded by a lighter band known as 'white' maple. The results of comparative strength tests demonstrated that no weak plane occurred at the juncture

of the brown heart and white wood, and that there is no clearly defined difference between the strength of brown heart and white material in shear, cleavage, or tension. The presence of brown heart in wood to be used for making last-blocks is not a serious defect, if the necessary care is taken during seasoning to ensure that stresses in the material are correctly relieved and that moisture distribution is uniform.

The origin of the condition is uncertain. Traces of a fungus are occasionally visible in both brown and white areas, but cultures proved negative, and in many brown heart areas there appeared to be no fungus present. The condition does not increase in intensity from the pith towards the white wood, but occupies irregularly spaced annular zones with areas of lighter brown heart wood between. The abnormal density of the affected parts supports the hypothesis that brown heart is a form of mineral staining.

Destructive Insect and Pest Acts, Scotland. The Wart Disease of Potatoes (Scotland) Order of 1938. Dated June 3, 1938.—11 pp., 1938.

The Wart Disease of Potatoes (Scotland) Order of 1938, effective as from 1st July, 1938, prohibits the planting of non-immune varieties, except by special permission of the Department of Agriculture, in (*a*) holdings not exceeding half an acre in extent, (*b*) private gardens, or (*c*) holdings in which *Synchytrium endobioticum* is known to have existed at any time, to which the provisions of the Order of the same name of 1923 [*R.A.M.*, iii, p. 112] have been applied, in which the disease may at any time subsequent to the date of the present Order be found, or to which it is likely in responsible opinion to spread. The First Schedule to the Order contains a list of infected areas. Details are given of the precautions to be adopted in case of an outbreak of disease. Potatoes from England and Wales and abroad may be planted only under licence from the Department, and from Northern Ireland and Eire if certified as grown on land at least one mile distant from any infected area. Scottish-grown material for planting in England and Wales must be similarly certified.

Union of South Africa. Department of Agriculture and Forestry. Agricultural Pests Act (Act No. 11 of 1911), as amended. Agricultural Pests (Citrus Canker) Act (Act No. 10 of 1919) and Psorosis Act (Act No. 42 of 1927). Proclamations, Government Notices and Regulations.—54 pp., 1937. Proclamations Nos. 201, 202 of 1937.—*Govt Gaz., Pretoria,* No. 2471, 1937. [Received October, 1938.]

Particulars are given of the provisions of the Acts mentioned in the title and of certain proclamations under these acts. Proclamation No. 201 of 1937 (30th September) excludes the territory administered by the Companhia de Moçambique outside the Districts of Beira, Buzi, Neves, Ferreira, and Cheringoma (Portuguese East Africa) from the provisions of the Agricultural Pests Act, 1911, regulating the introduction of citrus fruit into the Union. Proclamation No. 202 of 1937 (30th September) provides for the exclusion of citrus fruits from the Districts mentioned above and of all citrus fruits outside these Districts, unless accompanied by a certificate from the Department of Agriculture, Beira, giving full particulars of their origin.

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